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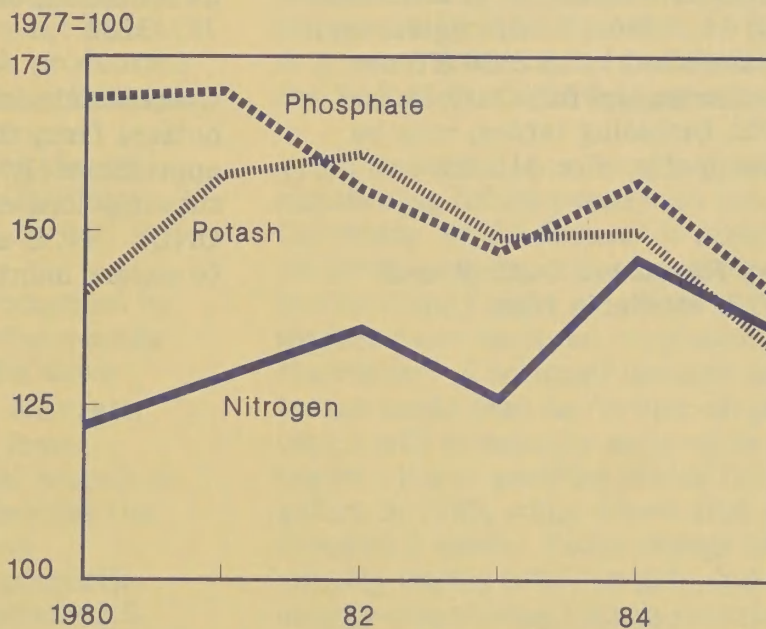
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Agricultural Resources

Inputs Outlook and Situation Report

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Fertilizer Prices Decline



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Situation Coordinator
Herman W. Delvo

Paul Andrienas (Fertilizer) (202) 786-1456
Herman W. Delvo (Pesticides) (202) 786-1456
Michael Hanthorn, Carlos Sisco (Farm Machinery) (202) 786-1456
Mohinder Gill (Energy) (202) 786-1456

Natural Resource Economics Division, Economic Research Service
U.S. Department of Agriculture, Washington, D.C. 20005-4788

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SUMMARY

Prices for manufactured farm inputs will be generally lower in 1986, but input use is likely to decline as farmers plant fewer acres due to expected heavy participation in commodity programs. Nitrogen and phosphate prices could be down 5 percent this spring, with potash prices down 10 percent. Pesticide prices quoted by manufacturers for the 1986 crop season are virtually unchanged from a year earlier. Sales incentives and reduced interest rates have lowered the cost of purchasing new farm machinery, but farmers will still buy less new and used equipment than a year earlier because of continuing financial difficulties. Farm fuel prices may be lower in 1986 with increased oil production resulting in falling oil prices on the world spot market.

U.S. fertilizer use is expected to decline about 5 percent during July 1985/June 1986. Nitrogen use is forecast at 10.9 million tons, while phosphate and potash use are projected at about 4.4 and 5.3 million tons, respectively. Supplies of all fertilizer materials are expected to be adequate. Domestic production of nitrogen, phosphate, and potash could slow this year because of a decline in domestic use and exports.

World fertilizer production should be adequate to meet demand for the next 4 to 5 years. World phosphate and potash production capacity is likely to remain excessive through 1990. Production capacity for nitrogen fertilizer is projected to grow more slowly than use during 1985-90, resulting in rising nitrogen fertilizer prices.

Abundant world phosphate production in 1984/85 has temporarily satiated the market and U.S. exports are expected to be down about 14 percent during 1985/86. Nitrogen and potash exports could be down from year-earlier levels, but the general growth in world use of these nutrients will temper the decline. On the import side, a more competitive cost structure in the domestic nitrogen fertilizer industry will reduce U.S. nitrogen fertilizer imports in 1985/86 as it did

a year earlier. Potash imports also will decline because of less domestic use.

Farm pesticide use this year could range from 445 to 500 million pounds active ingredient (a.i.) compared with 505 million pounds in 1985. Domestic supplies are expected to be up 1 percent. Herbicide prices declined 6 and 4 percent, respectively, during the past 2 years, while insecticide prices remained stable. These price trends should continue in 1986, with keen retail price competition this spring.

U.S. farmers are forecast to purchase \$5.25 to \$5.5 billion of new and used farm machinery in 1986, down from an estimated \$6.1 billion last year. In particular, demand for large farm wheel tractors and grain harvesting equipment will be down. Domestic market inventories of the major machinery items are still high relative to current sales. Therefore, manufacturers will operate at low capacity this year, and retailers will continue to offer significant sales incentives.

The farm machinery trade balance was a positive \$260 million through October 1985, but 37 percent below a year earlier. U.S. exports fell 17 percent to \$1.58 billion, while imports declined 11 percent to \$1.32 billion. A greater share of the farm machinery sold in the United States is being produced overseas.

Considerable uncertainty exists concerning future petroleum prices. Currently, world demand is stable and major oil-producing countries have increased production. Crude oil prices on the world spot market have declined considerable since November. Continued demand and production trends could lead to further oil price declines, which will eventually show up in farm fuel prices. Farm gasoline prices fell 1 cent a gallon in 1985, while diesel fuel and LP gas dropped 3 cents. Farm energy use decreased slightly during 1985, largely due to continued energy-conserving tillage practices.

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FERTILIZER

Demand

U.S. plant nutrient consumption likely will decline about 5 percent in 1985/86 because of fewer crop acres and stable fertilizer application rates. Plant nutrient use is forecast at 10.9 million tons for nitrogen and 4.4 and 5.3 million tons, respectively, for phosphate and potash.

While world fertilizer use is likely to continue growing, U.S. exports could decline. Record phosphate exports in 1984/85 have temporarily satiated the market, reducing U.S. export prospects in 1985/86. The slowing of diammonium phosphate exports early in 1985/86 may cause phosphate exports for the year to decline 14 percent to about 4.8 million tons. Nitrogen and potash exports could be down from year-earlier levels, but the general growth in world use of these nutrients will limit the decline and should provide increased demand for U.S. exports in future years.

Farm use of nitrogen rose in 1984/85 as favorable conditions in corn growing areas encouraged increased nitrogen use. However, farmers reduced phosphate and potash use to cut costs. Farmers can temporarily reduce

phosphate and potash use without adversely affecting crop yields because of soil fertility carryover from previous year applications.

Supplies

Domestic supplies of all fertilizers are expected to be ample in 1985/86. Current anhydrous ammonia production rates indicate an 85-percent operating rate with an annual capacity capable of producing 18 million tons. Wet-process phosphoric acid facilities capable of producing 11.1 million tons are operating at about 88 percent of capacity. U.S. potash capacity (1.8 million tons) is operating at a 75-percent rate, while Canadian capacity (11.3 million tons) is operating at about 58 percent. These rates are down from year-earlier levels, portending an overall decline in capacity utilization rates for the 1985/86 fertilizer production year.

U.S. nitrogen production could be down about 1 percent in 1985/86 (table 1). Production will not fall as much as domestic demand because of the improved competitive position of the U.S. nitrogen fertilizer industry. Prices paid by U.S. anhydrous ammonia producers for natural gas feedstock have stabilized or declined, lowering industry costs and allowing domestic production to replace imports.

Table 1--U.S. supply-demand balance for year ending June 30

Item	Nitrogen			Phosphate			Potash		
	1984	1985	1986 1/	1984	1985	1986 1/	1984	1985	1986 1/
Million nutrient tons									
Producers' beginning inventory	2.00	1.66	1.42	.66	.81	.77	.46	.31	.30
Production	12.36	13.70	13.56	10.55 2/	11.21 2/	10.37 2/	1.62	1.56	1.41
Imports	4.02	3.73	3.66	.10 2/	.14 2/	.11 2/	5.29	5.48	5.26
Total available supply	18.38	19.09	18.64	11.31	12.16	11.25	7.37	7.35	6.97
Agricultural consumption	11.15	11.50	10.90	4.93	4.64	4.40	5.81	5.51	5.30
Exports	2.05	3.20	3.05	4.33 2/	5.53 2/	4.77 2/	.53	.59	.56
Total agricultural and export demand	13.20	14.70	13.95	9.26	10.17	9.17	6.34	6.10	5.86
Producers' ending inventory	1.66	1.42	1.60	.81	.77	.80	.31	.30	.31
Available for non-agricultural use	3.52	2.97	3.09	1.24	1.22	1.28	.72	.95	.80

1/ Forecast. 2/ Does not include phosphate rock.

Source: (1,4,5,6).

Table 2—U.S. production of fertilizer nutrients for year ending June 30

Material	1984	1985 1/	Annual change
	Thousand tons		Percent
Nitrogenous fertilizers: 2/			
Anhydrous ammonia 3/	15,043	16,709	11
Ammonium nitrate, solid	2,700	2,389	-12
Urea 3/	6,314	7,219	14
Nitrogen solutions	2,878	3,261	13
Phosphate fertilizers: 4/			
Normal and enriched superphosphate	98	103	5
Triple superphosphate	1,153	1,145	-1
Diammonium phosphate	5,112	5,602	10
Other ammonium phosphates	1,088	905	-17
Total	7,451	7,755	4
Wet-process phosphoric acid 5/	9,883	10,559	7
Muriate of potash: 6/			
United States	1,620	1,559	-4
Canada	7,888	8,029	2

1/ Preliminary. 2/ Total not listed because nitrogen solutions are in 1,000 tons of N, while other nitrogen products are in 1,000 tons of material. 3/ Includes material for nonfertilizer use. 4/ Reported in 1,000 tons P₂O₅. 5/ Includes merchant acid. 6/ Reported in 1,000 tons of K₂O.

Source: (1,6).

Nitrogen fertilizer production increased in 1984/85 in response to higher domestic and net export demand. Anhydrous ammonia production advanced about 11 percent to 16.7 million tons (table 2). Production of urea and nitrogen solutions rose about 13 percent, while solid ammonium nitrate production declined by approximately the same percent.

Because of reduced domestic use and exports, U.S. phosphate production is expected to decline about 8 percent in 1985/86. Overcapacity and low prices have created financial problems for the U.S. phosphate fertilizer industry in recent years. Producers misjudged the growth in phosphate fertilizer use in this decade and built unneeded production capacity. In 1984/85, excess production caused phosphate fertilizer prices to fall to unprofitable levels. According to FAO/World Bank projections, the world surplus

of phosphate fertilizer production capacity is expected to continue through 1990 and producers will need to reduce operating rates to maintain prices at profitable levels.

Production of phosphate fertilizer materials increased in 1984/85 as export demand rose to record levels. Total output of selected phosphate fertilizer was up 4 percent from a year earlier. Diammonium phosphate production rose 10 percent after a 23-percent increase a year earlier. Triple superphosphate production remained close to the 1983/84 level.

The competitive position of U.S. potash producers continues to deteriorate in both the domestic and export markets. In 1985/86, the U.S. potash industry will be hard pressed to maintain year-earlier production levels. Competition from suppliers in Canada and other countries is expected to prevent growth in U.S. exports and could reduce the U.S. industry's share of the domestic market. After a 4-percent decline in 1984/85, U.S. potash production could fall for the sixth consecutive year in 1985/86. Imports are expected to decline about 4 percent.

U.S. potash producer inventories in 1984/85 followed normal seasonal patterns with stocks generally in line with year-earlier levels. However, Canadian potash producers failed to reduce production when exports fell, causing ending inventories to rise 13 percent from a year earlier. High inventory levels and a decline in sales last fall caused Canadian potash producers to lower prices 10 to 12 percent per ton for orders made after December 6, 1985, and delivered before January 15, 1986.

Farm Prices

The expected decline in fertilizer use and plentiful supplies in 1985/86 should reduce farm fertilizer prices. Spring 1986 nitrogen and phosphate prices could average as much as 5 percent under a year earlier, while potash prices could be down more than 10 percent. Fertilizer producers will adjust to soft prices by limiting production.

Readily available supplies offset strong seasonal demand for fertilizer in the spring of 1985, resulting in an uncharacteristic decline in fall-to-spring prices. Farm fertilizer prices

Table 3--Average U.S. farm prices for selected fertilizer materials 1/

Year	Anhydrous ammonia (82%)	Triple superphosphate (44-46%)	Diammonium phosphate (18-46-0%)	Potash (60%)	Mixed fertilizer (6-24-24%)
Dollars per ton					
1982: May	255	228	262	155	219
1983: May	237	214	249	143	206
1984: May	280	231	271	147	217
October	259	210	250	134	205
December	252	208	246	132	202
1985: May	252	203	240	128	192
October	237	195	229	113	182
December	233	192	224	109	177

1/ Based on a survey of fertilizer dealers conducted by the Statistical Reporting Service, USDA.

Table 4--U.S. imports of selected fertilizer materials for year ending June 30

Material	1983	1984	1985	1986 1/
Thousand tons				
Nitrogen:				
Anhydrous ammonia	2,144	3,259	2,956	1,167
Urea	1,636	2,083	1,990	737
Ammonium nitrate	267	494	542	198
Ammonium sulfate	306	354	370	121
Sodium nitrate	117	108	147	24
Calcium nitrate	140	164	155	36
Nitrogen solutions	125	308	197	105
Other	81	125	253	50
Total	4,816	6,895	6,610	2,436
Phosphate:				
Ammonium phosphates	214	188	201	48
Crude phosphates	38	8	11	34
Phosphoric acid	6	*	1	*
Normal and triple superphosphate	14	11	7	1
Other	8	4	2	1
Total	280	211	222	84
Potash:				
Potassium chloride	7,323	8,574	8,893	2,883
Potassium sulfate	31	68	68	15
Potassium nitrate 2/	53	43	57	24
Total	7,407	8,685	9,018	2,922
Mixed fertilizers	120	134	152	25
Total	12,623	15,925	16,002	5,468
Total value 3/	1.26	Billion dollars 1.54	1.51	.47

* Less than 1,000 tons.

1/ Preliminary data for July-November 1985. 2/ Includes potassium sodium nitrate. 3/ Value by fertilizer material in appendix table 1.

Source: (5).

in May 1985 averaged about 8 percent below a year earlier and declined another 5 percent by December (table 3). December 1985 potash prices were down the most, dropping 15 percent from May, while triple superphosphate and diammonium phosphate prices dropped by 5 and 7 percent, respectively. Price drops for nitrogen fertilizer materials ranged from 2 to 10 percent. Anhydrous ammonia and urea prices declined 8 and 10 percent, respectively, while ammonium nitrate prices declined 3 percent.

Table 5—U.S. exports of selected fertilizer materials for year ending June 30

Material	1983	1984	1985	1986 1/
Thousand tons				
Nitrogen:				
Anhydrous ammonia	426	390	1,069	419
Urea	1,317	1,034	1,388	415
Ammonium nitrate	29	19	34	44
Ammonium sulfate	660	672	829	273
Sodium nitrate	19	17	21	11
Nitrogen solutions	121	17	7	32
Other	57	53	58	37
Total	2,629	2,202	3,406	1,230
Processed phosphate:				
Normal super-phosphate	62	41	4	1
Triple super-phosphate	1,425	1,140	1,556	634
Diammonium phosphate	4,557	5,501	7,896	2,383
Other ammonium phosphate	312	500	544	259
Phosphoric acid	1,522	1,570	1,515	246
Other	9	2/	2/	3/
Total	7,887	8,752	11,515	3,522
Phosphate rock 2/	11,913	13,448	11,694	5,057
Potash:				
Potassium chloride	723	567	795	279
Other	399	276	233	177
Total	1,122	843	1,028	455
Mixed fertilizers	187	140	99	46
Total	23,738	25,385	27,742	10,310
Billion dollars				
Total value 4/	2.2	2.3	2.9	3/

1/ Preliminary data for July–November 1985. 2/ Effective January 1984 through June 1985, phosphate rock exports include a small tonnage of miscellaneous fertilizers. 3/ Not available. 4/ Value by fertilizer material in appendix table 2.

Source: (4).

Fertilizer Trade

Fertilizer imports in 1984/85 almost equaled their year-earlier volume with value down about 2 percent (table 4). About 16 million tons of fertilizer materials valued at \$1.5 billion were imported. Fertilizer exports were up about 9 percent at 27.7 million tons (table 5). Value of exported fertilizer materials rose 26 percent to \$2.9 billion.

Lower U.S. fertilizer prices in 1984/85 enhanced foreign sales, resulting in record nitrogen and phosphate exports. A more competitive cost structure in the U.S. nitrogen fertilizer industry reduced nitrogen fertilizer imports, while a less competitive position in the U.S. potash industry modestly increased potash imports. Asian countries were the top customers for U.S. fertilizer, with India taking 17 percent of the total plant nutrients exported, while China took 11 percent. On the import side, Canada was the leading supplier, providing a substantial share of nitrogen imports and almost all the potash imports.

Nitrogen

According to U.S. Department of Commerce statistics, nitrogen imports in 1984/85 were down primarily because anhydrous ammonia and urea imports declined 9 and 5 percent, respectively (table 4). Together, anhydrous ammonia and urea accounted for 89 percent of the 3.7 million tons of nitrogen imported in 1984/85. Anhydrous ammonia made up 64 percent, about the same portion as a year earlier, and urea accounted for 25 percent. The remaining 11 percent of nitrogen imports consisted of nitrogen solutions, ammonium nitrate, ammonium sulfate, ammonium phosphates, sodium nitrate, and mixtures.

Canada remained the most important supplier of nitrogen fertilizer, providing about 39 percent of imports. The Soviet Union was the second-ranking supplier, accounting for 25 percent, while Trinidad–Tobago and Mexico provided 16 and 4 percent, respectively. Romania became a significant nitrogen supplier in 1984/85, providing 6 percent of U.S. nitrogen imports.

Several anhydrous ammonia suppliers increased their share of ammonia imports.

Canada's share rose from 30 to 34 percent, the Soviet Union's from 27 to 32, and Trinidad-Tobago's from 21 to 24 percent. Mexico's share declined for the second year to 6 percent of the total.

Canada remained the largest urea supplier, increasing its share of U.S. urea imports from 38 to 44 percent. The Soviet Union's share declined from 25 to 18 percent. A newcomer, Romania, provided 17 percent, while Mexico's share dropped to less than 1 percent.

Canada, Trinidad-Tobago, and Romania have increased nitrogen fertilizer production, resulting in greater export sales. Competitive pricing by these producers has moved more product into the U.S. market. Mexico is using more of its production at home, causing reduced shipments to the United States.

U.S. nitrogen exports in 1984/85 were up because of increased foreign sales of diammonium phosphate, anhydrous ammonia, and urea (table 5). The three products accounted for 92 percent of all nitrogen exports. Diammonium phosphate accounted for 44 percent, while anhydrous ammonia and urea made up 28 and 20 percent, respectively.

Based on their purchases of diammonium phosphate and urea, Asian countries were the most important foreign market for U.S. nitrogen fertilizer. India accounted for 16 percent of nitrogen exports, China 11 percent, Republic of Korea 10 percent, Taiwan 5 percent, and Japan 4 percent. Belgium-Luxembourg purchased 8 percent, while Brazil bought less than 3 percent.

Phosphate

Phosphate exports reached record levels in 1984/85 as plentiful supplies and low prices caused diammonium phosphate exports to surge an unprecedented 44 percent to 7.9 million tons. Diammonium phosphate accounted for 65 percent of total phosphate exports.

Triple superphosphate exports were up 37 percent from 1983/84, contributing 13 percent to phosphate exports. Exports of phosphoric acid were off 4 percent, reducing its

contribution to 17 percent of phosphate exports.

India and China were the largest purchasers of U.S. phosphate fertilizer in 1984/85, with India accounting for a fifth of U.S. phosphate exports, and China, 13 percent. Other important customers were the Soviet Union with 7 percent, and Taiwan and Japan with 4 and 6 percent, respectively.

India and China were the largest purchasers of diammonium phosphate with India buying almost a fourth and China a fifth of U.S. exports. Other country shares—Belgium-Luxembourg, Taiwan, Japan, Pakistan, and Mexico—ranged from 4 to 9 percent.

U.S. phosphate rock exports declined 13 percent to about 11.7 million tons, as rock production from other countries replaced U.S. product. Also, there has been a trend toward shipping processed phosphate fertilizer rather than rock.

Potash

U.S. potassium chloride imports rose about 4 percent in 1984/85 to about 8.9 million tons (table 4). Potassium chloride accounted for almost all potash imports with Canada providing about 93 percent. Israel was the only other significant supplier, with 6 percent.

U.S. exports of potassic fertilizer materials advanced about 22 percent in 1984/85 (table 5). Close to 1 million tons were shipped, with potassium chloride accounting for 77 percent of the total, and potassium sulfate making up about 9 percent.

Fertilizer Use Estimates

In the year ending June 30, 1985, about 49 million tons of fertilizer materials were used in the United States and Puerto Rico, 2 percent less than in 1983/84 (table 6). In terms of total plant nutrients, use was down 1 percent to 21.7 million tons. Nitrogen applications increased 4 percent to 11.5 million tons. Phosphate use amounted to 4.64 million, 5 percent below a year earlier. Potash consumption, at 5.51 million tons, was also down 5 percent.

Table 6--U.S. fertilizer consumption 1/

Year ending June 30	Total fertilizer materials	Primary nutrient use				Share of 1977 total nutrient use
		N	P ₂ O ₅	K ₂ O	Total 2/	
		Million tons				Percent
1976	49.2	10.4	5.2	5.2	20.8	94
1977	51.6	10.6	5.6	5.8	22.1	100
1978	47.5	10.0	5.1	5.5	20.6	93
1979	51.5	10.7	5.6	6.2	22.6	102
1980	52.8	11.4	5.4	6.2	23.1	105
1981	54.0	11.9	5.4	6.3	23.7	107
1982	48.7	11.0	4.8	5.6	21.4	97
1983	41.8	9.1	4.1	4.8	18.1	82
1984	50.1	11.1	4.9	5.8	21.8	99
1985	49.0	11.5	4.6	5.5	21.7	98

1/ Includes Puerto Rico. Detailed State data shown in appendix table 3. 2/ Totals may not add due to rounding.

Less fertilizer was used in most regions of the country in 1984/85, although fertilizer use in the Lake States and Northern Plains increased 4 and 10 percent, respectively. Declines in the other regions ranged from 1 to 8 percent (table 7). Nitrogen use increased in five regions--the Northeast, Lake States, Corn Belt, Northern Plains, and Appalachia (table 8). Phosphate use was up in the Northern Plains, while potash use was up in the Southern Plains and Mountain regions.

Table 7--Regional plant nutrient consumption for year ending June 30 1/

Region	1984	1985	Annual changes
	Thousand tons		Percent
Northeast	841	839	-1
Lake States	2,639	2,754	4
Corn Belt	7,363	7,202	-2
Northern Plains	2,246	2,468	10
Appalachia	1,725	1,706	-1
Southeast	1,751	1,683	-4
Delta States	1,055	974	-8
Southern Plains	1,656	1,620	-2
Mountain	1,001	954	-5
Pacific 2/	1,481	1,430	-3
U.S. total 3/	21,761	21,626	-1

1/ Includes N, P₂O₅, and K₂O. Totals may not add due to rounding. 2/ Includes Alaska and Hawaii. 3/ Excludes Puerto Rico. Detailed State data shown in appendix table 3.

The portion of fertilizers applied as mixtures continued to decline, dropping to 40 percent of total use as direct application of single nutrient materials rose to 60 percent (table 9).

Nitrogen application rates on corn reached record levels and potash application rates on soybeans were unchanged (table 10). All other fertilizer application rates on corn, cotton, soybeans, and wheat were down.

Corn for Grain

Some fertilizer was applied to 98 percent of the harvested corn acreage in 1984/85. The portion of corn acres on which nitrogen was used remained unchanged, while the share fertilized with phosphate and potash declined from the previous year. Nitrogen applications reached a record 140 pounds an acre. Phosphate and potash application rates declined from 65 to 60 and from 87 to 84 pounds an acre, respectively.

Cotton

About 76 percent of the harvested cotton acreage received some fertilizer in 1984/85. Compared with 1983/84, the proportion of cotton acres fertilized with nitrogen remained unchanged. The share fertilized with phosphate increased from 48 to 50 percent, while that fertilized with potash rose from 32 to 34 percent. Although the proportions of cotton acres fertilized with phosphate and

Table 8--Regional plant nutrient use for year ending June 30 1/

Region	1984	1985	Annual changes
	Thousand tons		Percent
Nitrogen:			
Northeast	322	329	2
Lake States	1,025	1,161	13
Corn Belt	3,321	3,460	4
Northern Plains	1,614	1,830	13
Appalachia	684	683	1
Southeast	736	738	-
Delta States	561	551	-2
Southern Plains	1,118	1,097	-2
Mountain	687	655	-5
Pacific 2/	1,012	985	-3
U.S. total 3/	11,080	11,492	4
Phosphate:			
Northeast	240	227	-5
Lake States	594	574	-3
Corn Belt	1,611	1,483	-8
Northern Plains	507	513	1
Appalachia	435	434	-
Southeast	353	334	-5
Delta States	208	179	-14
Southern Plains	380	361	-5
Mountain	267	246	-8
Pacific 2/	301	287	-5
U.S. total 3/	4,896	4,636	-5
Potash:			
Northeast	282	283	-
Lake States	1,020	1,019	-
Corn Belt	2,431	2,259	-7
Northern Plains	125	125	-
Appalachia	606	584	-4
Southeast	662	611	-8
Delta States	286	244	-15
Southern Plains	158	162	3
Mountain	47	53	13
Pacific 2/	168	158	-6
U.S. total 3/	5,785	5,498	-5

1/ Totals may not add due to rounding.
2/ Includes Alaska and Hawaii. 3/ Excludes Puerto Rico. Detailed State data shown in appendix table 3.

potash increased, application rates declined for all three plant nutrients. Nitrogen application rates declined from 81 to 80 pounds an acre, phosphate from 48 to 46 pounds, and potash from 53 to 52 pounds.

Table 9--Average annual U.S. fertilizer use 1/

Year ending June 30	Mixtures 2/		Materials 3/	
	Quantity	Share of total	Quantity	Share of total
	Million tons	Percent	Million tons	Percent
1976	23.0	47	26.2	53
1977	24.1	47	27.5	53
1978	22.1	47	25.4	53
1979	23.7	46	27.7	54
1980	23.3	44	29.5	56
1981	23.5	44	30.5	56
1982	20.9	43	27.8	57
1983	18.4	44	23.5	56
1984	21.2	42	28.9	58
1985	19.5	40	29.5	60

1/ Includes Puerto Rico. 2/ Mixtures that contain more than one primary nutrient. 3/ Direct application materials including primary, secondary, and micro nutrients.

Soybeans

The proportion of soybean acres fertilized declined from 34 to 32 percent with nitrogen falling to 17 percent, phosphate to 28, and potash to 30. Also, application rates fell from 17 to 15 pounds for nitrogen and from 46 to 43 pounds for phosphate, while potash rates remained at 72 pounds per acre.

Wheat

The share of wheat acres fertilized increased for the third consecutive year to 77 percent of total harvested acres. The share receiving nitrogen increased to 77 percent, while the proportions receiving phosphate and potash dropped from 49 to 48 percent, and 17 to 16 percent, respectively. Nitrogen application rates decreased 2 pounds an acre to 60 pounds, while phosphate application rates were also down 2 pounds to 35 pounds. Potash application rates declined substantially to 36 pounds.

World Fertilizer Review and Prospects

World fertilizer production and use recovered in 1983/84 as improved economic conditions in agriculture overseas increased demand. Depressed economic conditions had

Table 10--Fertilizer use on selected U.S. field crops 1/

Crop, year	Total U.S. harvested acres	Harvested acres receiving				Application rates		
		Any fertilizer	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
	Million		Percent				Pounds per acre	
Corn for grain:								
1981	74.5	97	97	90	84	137	67	85
1982	72.7	97	97	88	84	135	65	85
1983	51.5	96	96	88	83	137	64	85
1984	71.8	97	97	87	82	138	65	87
1985	74.8	98	97	86	79	140	60	84
Cotton:								
1981	13.8	75	75	52	30	72	45	46
1982	9.7	71	71	41	30	82	46	55
1983	7.3	68	68	44	30	81	45	52
1984	10.5	77	76	48	32	81	48	53
1985	10.3	76	76	50	34	80	46	52
Soybeans:								
1981	66.2	36	21	33	35	18	45	76
1982	69.4	30	17	27	29	17	43	68
1983	62.5	33	20	30	32	18	45	70
1984	66.1	34	20	30	32	17	46	72
1985	62.2	32	17	28	30	15	43	72
All wheat:								
1981	80.6	70	70	47	20	58	39	47
1982	77.9	70	70	45	18	59	37	41
1983	61.4	73	72	48	20	60	39	48
1984	66.9	76	76	49	17	62	37	46
1985	64.6	77	77	48	16	60	35	36

1/ Detail for States by crop are found in appendix tables 1 through 7.

reduced world fertilizer use in 1981/82 and a massive reduction in acreage in 1982/83 kept U.S. use and production down. The strong U.S. recovery in fertilizer consumption and continued gains in the Soviet Union, China, and India upped world fertilizer production and use in 1983/84. Data for 1984/85 are not yet available; however, gains are not expected to match those of a year earlier.

Supplies

World plant nutrient supplies in 1983/84 increased 9 percent to about 126 million metric tons (table 11). Nitrogen supplies rose about 7 percent to almost 67 million tons, and phosphate supplies climbed about 9 percent to 33 million tons. Potash supplies increased 14 percent to 26.3 million tons.

In 1984/85, world fertilizer supplies were expected to be up about 7 percent, compared

Table 11--World plant nutrient supply and consumption for year ending June 30

Plant nutrient	1983	1984	1985 1/
Million metric tons			
Available supply: 2/			
Nitrogen	62.3	66.9	70.3
Phosphate	30.3	32.9	37.4
Potash	23.0	26.3	27.9
Total	115.6	126.1	136.6
Consumption:			
Nitrogen	61.1	66.9	69.8
Phosphate	30.6	32.9	34.0
Potash	22.9	25.4	25.7
Total	114.6	125.2	129.5

1/ Projected. 2/ Production less industrial uses and losses in transportation, storage, and handling.

Source: (2,3).

with a 9-percent year-earlier gain. Increased production in 1984/85 reflected a continuation of the 1983/84 recovery in fertilizer use. However, the recovery slowed in the second half of 1984/85, requiring a downward adjustment in production.

Consumption

World fertilizer consumption in 1983/84 increased 9 percent from a year earlier, to about 125 million metric tons (table 11). Nitrogen consumption rose 5.8 million metric tons (9 percent) to almost 67 million tons. Phosphate consumption was up 2.3 million tons (8 percent) to 33 million tons and potash use increased 2.5 million tons (11 percent) to over 25 million tons.

World plant nutrient use is expected to increase about 3 percent in 1984/85 in line with a projected long term growth rate for fertilizer consumption during 1985-90. Growth in consumption in 1984/85 will be well below the 9-percent rate experienced in each of the 1982/83 and 1983/84 recovery years.

Projections for 1985-90

During 1985-90, fertilizer production and use is expected to grow the fastest in the developing and centrally planned economies. Growth will be much slower in the developed countries because of the mature markets in the United States and Western Europe.

In the developing countries, production of the three plant nutrients will be up 40 percent or more by the end of the decade, while consumption will be up about a third (table 12). The rapid increase is attributable to the goals of many developing countries to move toward self-sufficiency in food production and, if possible, self-sufficiency in fertilizer production.

In the developed countries, plant nutrient consumption is expected to grow another 11 to 13 percent by 1990. Nitrogen and phosphate production is expected to grow about 3 percent, while potash production is projected to be up about 14 percent.

Most of the increased fertilizer production planned in the developed countries will come from greater Canadian potash and nitrogen production. The Canadians are

Table 12--Projected 1985-90 change in world fertilizer supply capability and demand 1/

World regions	Nitrogen	Phosphate	Potash
Percent increase			
Supply capability:			
Developed market economies	2	3	14
Developing market economies	51	42	86
Eastern Europe and the Soviet Union	5	14	12
Centrally planned countries of Asia	12	24	100
Total	14	14	14
Demand:			
Developed market economies	13	12	11
Developing market economies	28	32	36
Eastern Europe and the Soviet Union	18	13	31
Centrally planned countries of Asia	10	29	38
Total	15	18	22

1/ Detail in appendix table 8.

expected to expand potash production, maintaining their position as the major potash exporter. Canada will also expand nitrogen fertilizer production, primarily for the export market. In the United States, phosphate fertilizer production could rise. However, exports are expected to rise only modestly.

In the centrally planned countries, greater nitrogen fertilizer production will be limited primarily to China. In the Soviet Union, the expansion in nitrogen fertilizer production is essentially over with no significant expansion in anhydrous ammonia production capacity expected before 1990. However, some production gains are possible as the Soviets improve the operating rates of their plants.

Many developing countries have natural resources that can be used to produce nitrogen fertilizer, and expanded production is expected in India, Indonesia, Saudi Arabia, Mexico, Trinidad-Tobago, and Argentina. Increased production in these countries, plus others, will increase nitrogen fertilizer production capacity in Africa, Latin America, and Asia.

Morocco and Tunisia will account for 30 percent of the increase in world supplies of

processed phosphate fertilizers during 1985-90. Another 20 percent will result from additional production in the Soviet Union. Increased phosphate production in India, China, and Mexico will also add to larger world supplies.

The United States, Morocco, and China were the principal world phosphate rock producing countries in 1984, and will remain so in 1990. Other notable producers were Israel, Jordan, Senegal, South Africa, Togo, and Tunisia. By 1990 Jordan is expected to have significant phosphate rock production.

Over 80 percent of the increased potash production capability during 1985-90 will occur in Canada and the Soviet Union. Canadian production is expected to account for about half of the increase in world supplies. Also, production will rise in the Near East and Latin America.

Projected regional shares of world fertilizer supply and demand indicate a continuing shift in production and use away from the developed countries to the developing countries. The centrally planned countries' share of world fertilizer production will diminish, but their share of consumption will remain almost unchanged.

In 1990, the developed countries' share of world nitrogen supplies is expected to fall to 29 percent, while supplies from developing countries are projected to increase to 25 percent (table 13). Phosphate supplies from the developed countries will also drop, accounting for less than half of world supplies. Phosphate originating in the developing countries will increase to about 23 percent. The developed countries will continue to supply about 56 percent of the world's potash. The developing countries' share is expected to increase, but remain minimal at 2 percent.

In 1990, the developed countries are expected to use about 33 percent of the world's nitrogen, 36 percent of the phosphate, and 44 percent of the potash. In contrast, the developing countries will use about a fourth of the nitrogen and phosphate, but only 14 percent of the potash. In the developing countries, crop response to fertilizer applications has encouraged nitrogen and phosphate use at the expense of potash.

FAO/World Bank projections indicate that the developed country share of total world plant nutrient use will fall from 44 percent in 1980 to 36 percent in 1990, while the developing country share will increase from 18 to 22 percent. The centrally planned country share, projected at 42 percent in 1990, will be up from 38 percent in 1980, but almost unchanged from 1984.

North America, Western Europe, and Asia are projected to be nitrogen-deficit areas through 1990. Latin America, the Near East, Eastern Europe, and the Soviet Union will be surplus areas, as the countries in these areas with plentiful natural gas resources produce nitrogen fertilizer for the export market. Generally, the nitrogen deficit in the developed countries will grow in the 1985-90 period. However, in the developing countries nitrogen production is expected to grow faster than use, indicating that their deficit situation could disappear after 1990.

Based on current production capacity and planned capacity expansions, world nitrogen fertilizer production is projected to grow more slowly than use during 1985-90, which could result in higher nitrogen fertilizer prices.

Generally, the developed countries are projected to have a surplus of phosphate fertilizer, while Eastern Europe, the Soviet Union, and Asia are expected to be deficit areas. Africa, because of Moroccan and Tunisian production, and North America, because of U.S. production, will have the largest surpluses. Asia is expected to be the largest deficit area.

North America, because of increased Canadian production, is projected to have the largest potash surplus. Eastern Europe and the Soviet Union will be the other major surplus area. Western Europe, Asia, Africa, and Latin America are projected to be deficit areas.

World supplies of phosphate and potash fertilizer are expected to be adequate to satisfy demand for the remainder of this decade.

World Trade Developments

Eastern Europe and the Soviet Union should remain the dominant nitrogen exporters. The Soviet Union and Romania will

Table 13--Projected regional shares of world fertilizer supply capabilities and demand 1/

World regions	Nitrogen		Phosphate		Potash	
	1985	1990	1985	1990	1985	1990
Percent						
Supply:						
Developed market economies--	32.4	29.0	51.7	46.4	56.3	56.0
North America	16.6	15.0	26.6	24.4	33.6	35.1
Western Europe	14.0	12.7	16.3	14.4	18.6	16.9
Oceania	0.4	0.3	3.7	3.3	0	0
Other countries	1.4	1.0	5.1	4.3	4.1	4.0
Developing market economies--	18.8	25.0	18.1	22.6	1.5	2.4
Africa	0.3	0.9	6.5	9.4	0	0
Latin America	5.2	6.2	4.1	4.7	0.2	0.7
Asia	13.3	17.9	7.5	8.5	1.3	1.7
Eastern Europe and the Soviet Union	30.8	28.4	22.6	22.7	42.0	41.3
Centrally planned countries of Asia	18.0	17.6	7.6	8.3	0.2	0.3
Demand:						
Developed market economies--	33.7	32.5	38.2	36.1	48.5	44.2
North America	16.5	16.1	15.4	14.7	22.7	21.2
Western Europe	15.1	14.3	16.1	14.7	21.8	19.3
Oceania	0.4	0.4	3.3	3.2	1.0	1.0
Other countries	1.7	1.7	3.4	3.5	3.0	2.7
Eastern Europe and the Soviet Union	22.5	22.6	28.7	27.3	35.1	37.5
Centrally planned countries of Asia	21.5	20.3	12.1	13.2	3.5	3.9
Developing market economies--	22.3	24.6	21.0	23.4	12.9	14.4
Africa	1.0	1.2	1.7	2.0	1.1	1.1
Latin America	4.5	5.2	6.0	7.0	5.4	6.5
Asia	16.8	18.2	13.3	14.4	6.4	6.8

1/ Forecasts for year ending June 30.

Source: (2).

continue to supply nitrogen fertilizer to the nitrogen-deficit markets of North America, Western Europe, and Asia. Increased nitrogen fertilizer production in Trinidad-Tobago is targeted, primarily, for the North American and Western European markets. Surplus nitrogen from the Near East will probably move to the Asian market.

Within the North American market, Canada is adding anhydrous ammonia and urea capacity. New nitrogen fertilizer production in Western Canada is intended primarily for shipment to the United States.

Growth in the African phosphate industry continues to affect world trade patterns for phosphate fertilizer. Since Morocco and Tunisia built phosphoric acid production capacity, they have become serious participants in the processed phosphate fertilizer market. Their exports of phosphate rock are being augmented with shipments of

phosphoric acid and diammonium phosphate. The two countries are expected to further penetrate the European, Latin American, and Asian markets as they build additional phosphoric acid and diammonium phosphate plants. Phosphate fertilizers produced by Morocco and Tunisia are expected to compete with U.S. production in world markets.

The United States continues to dominate world trade in diammonium phosphate, but it will be challenged by other countries that have built diammonium phosphate production facilities and have emerged as exporters. Among these countries, Tunisia, Jordan, and South Korea are the most significant.

Asia has become the largest market for diammonium phosphate and the United States currently is the leading supplier, but North Africa and the Near East are competing for the Asian market. In addition, nearly all the production capacity currently under

construction or expected to be built by 1990 is concentrated in the developing world. Asia is expected to add a large share of new production facilities, with several new plants proposed for India.

Western Europe, for the most part, offers limited scope for increased phosphate fertilizer use, but less developed parts of the region—Italy, Greece, Spain, Portugal, and Turkey—will likely experience increased consumption.

Eastern Europe continues to require phosphate fertilizer, but the effectiveness of local distribution systems and the ability to finance imports and investments in distribution and production will remain a constraint on future consumption levels.

In Latin America, the principal consumers of phosphate fertilizer, Mexico and Brazil, are due to bring new plants into production. Larger domestic production will encourage increased consumption.

Canada, the German Democratic Republic, and the Soviet Union are the dominant exporters of potash, and Canada is expected to gain further dominance. A greater proportion of Eastern Europe's production will go for domestic use, and Canada is expected to further penetrate the large Indian and Chinese markets.

World Fertilizer Prices

Ample supplies and reduced growth in world fertilizer use caused fertilizer prices to decline in 1984/85. Generally, declines were greatest for phosphate fertilizer materials and urea.

Phosphoric acid, diammonium phosphate, and triple superphosphate prices declined throughout 1984/85 as producers oversupplied the market. Intense competition among producers allowed buyers to impose their own conditions on the market. Producers were able to secure large volumes of business, but buyers had little difficulty in bargaining for

lower prices. Recent stability in phosphate fertilizer prices are the result of deliberate production cuts by the United States, Morocco, and other North and West African producers.

Potassium chloride prices were generally stable throughout 1984/85, but declined in early 1985/86. The market has been overshadowed by the widespread knowledge that Canadian producers have large inventories. Demand among the leading importers has slackened, further affecting efforts to maintain 1984/85 price levels.

A saturated market caused urea prices to decline in 1984/85. Anhydrous ammonia prices declined less, but a languishing nitrogen fertilizer market has prevented a strong recovery in prices.

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PESTICIDES

Demand

U.S. farm demand for pesticides in 1986 is expected to be less than in 1985 due to an anticipated reduction in planted crop acres. Heavy farmer participation is expected in the commodity programs, but the acreage actually idled will not be known until later this spring. For participants, the feed grain (corn, sorghum, barley, oats) program calls for a 20-percent acreage reduction; rice a 35-percent reduction; wheat a 25-percent reduction; and cotton a 25-percent reduction. In addition, it is USDA's goal to enroll 5 million acres in the Conservation Reserve program in 1986. Under this program, highly erodible land will be removed from crop production for at least 10 years. Establishment of a permanent vegetative cover on this acreage also will be required.

Pesticide use on major field crops in 1986 could range from 445 to 500 million pounds active ingredient (a.i.), compared with 505 million estimated for 1985 (table 14). Corn will account for about 55 percent of all herbicide use and 45 percent of all insecticide use. Next in importance are soybeans (25 percent) for herbicide use and cotton (25 percent) for insecticide use. Fungicides are most commonly used in peanut production.

Supplies

Domestically produced pesticides available for U.S. farm use in 1986 are projected to be up 1 percent from 1985 (table 15). Production is expected to be up 2 percent while carryover from 1985 is projected to be down 6 percent. Pesticide exports are forecast to fall 5 percent in 1986 following a 4-percent decline from 1984 to 1985. Exports of each of the three major pesticide categories are likely to be down.

The decline in exports is primarily because of the high value of the U.S. dollar. Export commitments for 1986 generally were made prior to the recent fall in the dollar's value. If the dollar continues to depreciate, pesticide exports could increase in 1987.

Herbicide supplies in 1986 are forecast to be the same as in 1985 at 590 million pounds (a.i.). Producers reduced herbicide inventories 9 percent but in part offset them with a 3-percent increase in production. Insecticide supplies are projected to be up 7 percent, mainly due to a 13-percent larger carryover. Fungicide supplies may be down 9 percent, primarily because of reduced production and a smaller carryover.

Overall domestic plant capacity utilization is projected to be 66 percent for

Table 14--Estimated pesticide demand by U.S. field crop farmers

Crop	1985 planted acreage	Projected 1986 use		
		Herbicides	Insecticides	Fungicides
	Million	Million pounds (active ingredients)		
Row:				
Corn	83.2	215 - 238	26.6 - 29.4	.06
Cotton	10.7	14 - 16	14.1 - 15.6	.15
Grain sorghum	17.9	14 - 16	2.4 - 2.6	0.00
Peanuts	1.5	5 - 6	1.1 - 1.2	5.50
Soybeans	63.2	103 - 114	9.0 - 10.0	.06
Tobacco	.7	1 - 2	2.6 - 2.8	.35
Total	177.2	352 - 392	55.8 - 61.6	6.12
Small grains:				
Barley and oats	26.3	5 - 6	.1 - .2	0.00
Rice	2.5	10 - 11	.4 - .5	.06
Wheat	75.8	14 - 16	2.0 - 2.2	.86
Total	104.6	29 - 33	2.5 - 2.9	.92
Total	281.8	381 - 425	58.3 - 64.5	7.04

Table 15—U.S. pesticide production, inventories, exports, and domestic supply

Item	Quantity (active ingredients) 1/		
	1985	Pro- jected 1986	Projected change, 1985-1986
	Million pounds		Percent
Herbicides:			
Production	493	510	3
Carryover	201	182	-9
Exports	107	103	-4
Domestic supply	587	589	*
Insecticides:			
Production	191	193	1
Carryover	45	51	13
Exports	72	68	-6
Domestic supply	164	176	7
Fungicides:			
Production	59	55	-7
Carryover	13	10	-23
Exports	29	26	-10
Domestic supply	43	39	-9
All pesticides:			
Production	743	758	2
Carryover	259	243	-6
Exports	208	197	-5
Domestic supply	794	804	1

* Less than 1 percent.

1/ Production for surveyed producers only. These firms produce a major portion of all U.S. farm pesticides.

Source: USDA survey of basic pesticide producers, October 1985.

the 1986 pesticide production year (table 16). Herbicide producers are expected to operate at 68 percent of capacity in 1986. Insecticide producers plan to operate at 61 percent of capacity, compared with 30 percent in 1983 and 1984. Fungicide plants are projected to operate at 61 percent of capacity, down from 66 percent in 1985. Plant expansion in 1985/86 is projected at 1 percent, the same as in the last 3 years (table 17).

Pesticide prices quoted by manufacturers for the 1986 crop season are virtually unchanged from a year earlier with herbicide and insecticide prices up 1 percent (table 18). Retail level data indicate a substantial drop in herbicide prices in the last 2 years and fairly stable insecticide prices. The decline in

Table 16—U.S. pesticide production capacity utilization rates

Year	Herbi- cides	Insecti- cides	Fungi- cides	All pesticides
	Percent			
1976	91	85	82	86
1977	85	76	77	80
1978	81	87	83	83
1979	74	85	84	80
1980	77	79	84	78
1981	74	72	68	73
1982	84	68	70	80
1983	66	33	71	54
1984	67	29	73	52
1985	62	56	66	61
1986 1/	68	61	61	66

1/ Projected.

Source: USDA annual survey of basic pesticide producers.

Table 17—U.S. pesticide production capacity expansion

Year	Herbi- cides	Insecti- cides	Fungi- cides	All pesticides
	Percent			
1976/77	23	8	12	16
1977/78	3	4	3	3
1978/79	4	3	22	4
1979/80	2	1	3	2
1980/81	3	0	0	2
1981/82	4	7	0	5
1982/83	*	*	na	*
1983/84	0	6	0	1
1984/85	1	1	0	1
1985/86 1/	1	1	1	1

* Less than 1 percent.

na -- not available.

1/ Projected.

Source: USDA annual survey of basic pesticide producers.

herbicide prices was led by atrazine, butylate⁺, and trifluralin, which declined 6 to 8 percent between 1984 and 1985. An exception to the stable insecticide prices are the synthetic pyrethroids, which declined 5 percent in 1985.

With projected reductions in demand for herbicides and insecticides in 1986 and supplies above year-earlier levels, farm prices could weaken this spring. In addition, with lower commodity prices anticipated under the new farm program, farmers will be looking for

those products that will give them effective pest control at the lowest cost per acre.

Table 18--Pesticide price changes

Item	1983/84 1/	1984/85 1/	Projected 1985/86 2/
	Percent		
Herbicides	-6	-4	1
Insecticides	1	-1	1
Fungicides	na	na	0

na -- not available.

1/ May prices paid by farmers. 2/ Quoted manufacturer prices.

Source: USDA annual survey of basic pesticide producers.

1985 Pesticide Use

Wheat

In 1985, 44 percent of the U.S. wheat acres were treated with herbicides, compared with 42 percent in 1982, 38 percent in 1976, and 41 percent in 1971 (table 19). Herbicides

Table 19--Pesticide use on wheat, 1985 1/

State	Acres treated with	
	Herbicides	Insecticides
	Percent	
Arkansas	9	nr
California	48	24
Colorado	11	3
Idaho	85	15
Illinois	nr	nr
Indiana	8	2
Kansas	26	nr
Minnesota	56	3
Missouri	2	1
Montana	63	16
Nebraska	25	3
North Dakota	82	10
Ohio	3	3
Oklahoma	28	1
Oregon	97	3
South Dakota	57	6
Texas	17	7
Washington	93	5
18 State average 1/	44	5

nr -- none reported.

1/ States in survey harvested 57.8 million acres (89 percent of U.S. total).

are used extensively in wheat production in the Pacific Northwest and the Hard Red Spring region of North Dakota, Minnesota, Montana, and South Dakota. Herbicides are used on less than 10 percent of the wheat acreage in the Corn Belt.

Herbicide use in 1986 wheat production will be influenced by participation in the farm program. If participation is uniform across all wheat production regions, the proportion of acres treated with herbicides will range from 40 to 50 percent. However, if farmer participation is greater in the Northern Plains and Pacific Northwest, use could be lower than currently projected.

Insecticides were used on 5 percent of the wheat acreage in 1985, compared with 3 percent in 1982, 14 percent in 1976, and 7 percent in 1971. Use was highest in California, where 24 percent of the wheat acreage was treated in 1985. Idaho, Montana, and North Dakota farmers applied insecticides on 10 to 16 percent of their wheat acreage, primarily for grasshoppers.

In 1985, seasonal herbicide applications were made on 47 percent of the wheat acreage surveyed, compared with 44 percent treated with any herbicides (tables 19 and 20). This means that 3 percent of the acreage was treated in more than one season. Herbicide applications were made in the spring to 37

Table 20--Wheat herbicide applications, season and timing, 1985 1/

Season	Acres treated	Treatment timing 2/			
		Planting		Emergence	
		Before	At	Pre-	Post-
		Percent			
Fall	3	41	8	41	10
Winter	1	7	3	32	62
Spring	37	5	1	28	70
Summer	6	5	nr	4	93

nr -- none reported.

1/ See table 19 for States and total acres in survey. 2/ Can add to more than 100 percent because of multiple applications during a growing season.

percent (22 million acres) of the wheat acres. Spring herbicide applications were most common in the Hard Red Spring wheat area of the Northern Plains (55 percent), followed by the Pacific Northwest (20 percent). Most spring herbicide applications were postemergence (70 percent), followed by preemergence (28 percent). Summer herbicide applications were made to 6 percent (3.3 million acres) of the surveyed wheat acres. Herbicide applications in the fall were primarily before planting (41 percent) or preemergence (41 percent).

Corn for Grain

Herbicides were used on 96 percent of the surveyed corn acreage in 1985 (table 21). The acreage treated was greater than 90 percent in all States except South Dakota, where only 76 percent was treated. Insecticides were used on 45 percent of the corn acreage, ranging from 26 percent in Minnesota to 57 percent in Nebraska. Soil incorporation of insecticides to control corn rootworm larvae was practiced on 38 percent of the acreage in 1985, with foliar treatments made on 7 percent.

Of the 60 million acres of corn in surveyed States in 1985, atrazine was used on 35.2 million acres, followed by alachlor on 22.3 million (table 22). For the selected herbicides included in the survey, before or at planting or preemergence was the most common application time. The materials were used postemergence on only 5 to 15 percent of the treated acreage.

Soybeans

In 1985, 95 percent of the soybean acreage was treated with herbicides. North Carolina had the fewest treated acres at 78 percent. Insecticides were used on only 7 percent of the acreage, compared with 8 percent in 1984. However, insecticides were used on 58 percent of North Carolina's soybean acreage and 42 percent of Georgia's. Insects are a common problem for soybean production in the Southeast and Delta States, but usually not in the Corn Belt.

Trifluralin was used on 26 million acres in 15 States that accounted for about 54 million acres of soybeans in 1985. Metribuzin was used on 20.1 million acres, followed by

alachlor at 10.2 million acres. Trifluralin and metribuzin were generally applied before or at planting. In contrast, alachlor and linuron were primarily applied at planting or preemergence.

Table 21--Pesticide use on row crops, 1985 1/

Crop and State	Acres treated with	
	Herbicides	Insecticides
	Percent	
Corn:		
Illinois	99	52
Indiana	99	40
Iowa	99	50
Michigan	99	51
Minnesota	95	26
Missouri	98	30
Nebraska	93	57
Ohio	97	32
South Dakota	76	29
Wisconsin	96	56
10 State average	96	45
1984 average	95	42
Soybeans:		
Alabama	90	23
Arkansas	91	11
Georgia	91	42
Illinois	96	1
Indiana	96	3
Iowa	99	3
Kentucky	94	8
Louisiana	89	13
Minnesota	95	nr
Mississippi	95	10
Missouri	91	3
Nebraska	95	6
North Carolina	78	58
Ohio	97	3
Tennessee	98	1
15 State average	95	7
1984 average	94	8
Cotton:		
Alabama	100	98
Arizona	89	99
Arkansas	100	85
California	88	78
Georgia	100	100
Louisiana	100	100
Mississippi	99	96
Missouri	88	39
New Mexico	78	37
Oklahoma	90	21
South Carolina	100	98
Tennessee	99	76
Texas	93	45
13 State average	94	65
1984 average	93	63

nr -- none reported.

1/ States in survey harvested 59.9 million acres of corn (80 percent of U.S. total); 53.9 million acres of soybeans (87 percent); and 10.2 million acres of cotton (99 percent).

Table 22--Selected herbicides used on row crops, 1985 1/

Crop and material	Acres treated	Treatment timing			
		Planting		Emergence	
		Before	At	Pre-	Post-
	Thousand			Percent	
Corn:					
Atrazine 2/	35,200	34	22	30	14
Alachlor	22,300	27	28	37	8
Metolachlor 2/	11,600	47	24	24	5
Cyanazine	13,800	35	18	33	14
Linuron	150	nr	100	nr	nr
Soybeans:					
Trifluralin	26,000	87	13	na	na
Metribuzin	20,100	60	23	15	2
Alachlor	10,200	17	43	34	6
Metolachlor	5,800	40	32	25	3
Linuron	4,600	14	36	41	9
Cotton:					
Trifluralin	7,187	83	12	5	na
Cyanazine	1,500	8	11	6	75
Linuron	150	10	8	18	64

nr -- none reported.

na -- not applicable.

1/ See table 21 for States and total acres in survey. 2/ Does not include the product Bicep which contains atrazine + alachlor.

Cotton

An estimated 94 percent of the cotton acreage received a herbicide treatment in 1985. In the Southeast and Delta States, 100 percent of the acreage received herbicide treatments. Insecticides were used on 65 percent of the acreage, ranging from nearly 100 percent in the Southeast and Delta States to a low of 21 percent in Oklahoma. Texas treated 45 percent of its 4.7 million acres.

In the 13 major cotton-producing States, trifluralin was used on 7.2 of the 10.2 million harvested acres. Trifluralin was generally applied before planting, although some was applied at or immediately after planting but before weed emergence. Cyanazine was used on 1.5 million acres of cotton, with 75 percent of the acreage treated postemergence.

Regulatory Actions

Carbofuran -- In October 1985, EPA initiated a Special Review of all granular formulations of the insecticide-nematicide carbofuran, but not liquid formulations. The review covers all use sites. Carbofuran's acute toxicity to birds and a concern of secondary poisoning of raptors triggered the review.

Carbofuran is used primarily in corn, sorghum, and rice production. In 1982, farmers reported treating 5.5 million acres of corn, 1.1 million acres of sorghum, and 215,000 acres of rice with carbofuran. They also reported using it on peanuts, soybeans, and tobacco.

Carbofuran is used as a systemic and contact stomach poison. In corn and sorghum production, it is most commonly applied at planting in the seed furrow or in a 7-inch band over the row and incorporated in the top 1 inch of soil. Rootworm larvae in corn and greenbug and chinch bug in sorghum are the targets. Carbofuran can also be used as a foliar treatment in corn to control the European corn borer and Southwestern corn borer. In rice production, carbofuran can be applied 1 day before and up to 21 days after permanent flooding to control rice water weevil and mosquitos.

Diazinon -- EPA on January 6, 1986, announced the initiation of a Special Review and preliminary determination to cancel the registration of diazinon use on golf courses and turf farms. The Agency based its action on the risk posed to avian species. The risk analysis identified diazinon as the cause or likely cause of approximately 60 incidents of bird kills throughout the country involving 23 species. In one case, 700 Atlantic Brant Geese died after feeding on a golf course treated with diazinon that had been applied according to label directions.

In issuing the preliminary cancellation determination, EPA noted that the risk to birds was not outweighed by minor benefits associated with the use of diazinon on these sites. It was estimated that a nationwide diazinon cancellation would increase costs to

golf courses \$940,000 and turf farms \$300,000. EPA stated that these increased costs should not have any significant impact on either industry.

Daminozide -- On January 22, 1986, EPA issued an interim regulatory decision for the plant growth regulator daminozide in the production of apples and grapes. Registrations for other fruits, transplant tomatoes, peanuts, ornamentals, bedding plants, and nursery stocks were not affected by this decision.

The decision calls for the development of a data base for risk analysis. Oncogenicity (tumor causing), mutagenicity, and metabolism studies will be conducted over the next 4 years. However, interim sacrifices of test animals will be made to determine the presence of tumors and if they are cancerous. In addition, a dermal absorption and glove fabric permeability study will be conducted.

The interim decision also calls for reducing the label application rate from 4 to 3 pounds (a.i.) per acre and reducing the tolerance from 30 to 20 parts per million. There will continue to be an 8-pound-per-acre label rate for freeze-damaged apple trees but any fruit produced must be destroyed.

EPA also issued a user advisory that cautions against the use of daminozide-treated apples for the production of applesauce and juice. A metabolite of damonizide, UDMH, develops more quickly when subjected to heat.

There is a production cap on the manufacture of daminozide for use in grape production, but the production level is confidential information. Daminozide is used primarily on Concord-type grapes, which go into jams and jellies. A major processor of these products has indicated that it will no longer purchase grapes treated with daminozide.

Other Action -- During fiscal 1986, EPA plans to issue Position Document 2/3 outlining proposed regulatory actions for alachlor, aldicarb, amitrole, cadmium, cyanazine, dinocap, inorganic arsenicals (non-wood uses), pentachlorophenol (non-wood uses), and 2,4,5-TCP.

FARM MACHINERY

Demand

Financial Conditions

U.S. farmers are projected to purchase even less farm machinery in 1986 than in 1985 due to the weak domestic farm economy. Record to near-record field crop production in 1985 and a soft export market for agricultural commodities have combined to lower crop prices, further accentuating the financial difficulties in the farm sector. With both farm income and equity expected to continue falling, capital expenditures for farm machinery are forecast to total \$5.25 to \$5.5 billion in 1986, down 10 to 14 percent from an estimated \$6.1 billion last year (table 23).

With inflation projected to be about 3.5 percent this year, the Federal Reserve is expected to maintain a stimulative monetary policy. The annual average real prime interest rate (adjusted for inflation using the 1967 Consumer Price Index) is forecast to drop from about 6.2 percent in 1985 to 5.6 percent, the lowest annual level since 1980.

Even though the real prime interest rate has fallen significantly during the past several years, finance rates for farm loans remain relatively high. The margin between annual averages for the prime and farm loan rates has widened during the 1980's, reflecting the increased risk associated with agricultural loans. In 1986, the real national average Production Credit Association interest rate is expected to rise slightly to 8.9 percent and the Ninth (Minneapolis) Federal Reserve District's agricultural bank real short-term rate for nonreal estate farm loans is projected to increase to 9.9 percent. While average annual nominal farm loan rates are expected to remain near year-earlier levels, real farm loan rates are forecast to increase because of a slight decline in the projected rate of inflation.

Net farm income is forecast to decline in 1986 from a year earlier, primarily because of lower crop prices for the major export commodities and less export volume. Although huge commodity stocks are expected to hold down crop prices and the value of the U.S. dollar is projected to fall, U.S. agricultural exports in fiscal 1986 are forecast

Table 23--Trends in U.S. farm machinery capital expenditures and financial factors affecting demand for farm machinery

Item	1980	1981	1982	1983	1984	Projected 1985	Forecast 1986
Billion dollars							
Capital expenditures:							
Tractors	3.68	3.74	2.88	2.75	2.53	2.05	1.80-1.90
Farm machinery	6.96	6.48	5.10	4.82	4.75	4.05	3.45-3.60
Total	10.64	10.22	7.98	7.57	7.25	6.10	5.25-5.50
Factors affecting demand:							
Interest expenses	16.26	19.86	21.83	21.43	21.13	19.84	19.7
Total production expenses	129.39	136.13	136.92	135.63	139.50	134.11	130.6
Outstanding farm debt 1/	182.33	202.11	217.24	216.25	212.55	212.12	207-215
Farm real estate assets 1/	846.57	846.70	808.65	797.97	693.73	638.2 2/	600-620
Farm nonreal estate assets 1/	261.73	264.40	273.35	263.43	262.07	258.8 2/	242-278
Agricultural exports 3/	40.48	43.78	39.10	34.77	38.03	31.19	29.0
Net farm income	20.18	29.84	24.64	15.00	34.53	25-29	22-26
Net cash income	37.20	35.80	38.27	38.32	39.23	37-41	37-41
Percent 4/							
Real prime rate	1.75	8.50	8.73	7.57	7.88	6.17	5.60
Real PCA interest rate 5/	-0.78	4.09	8.45	8.73	8.20	8.67	8.90
Real nonreal estate operating loan rate 6/	1.30	7.50	10.95	11.08	10.25	9.69	9.92
Debt-asset ratio 7/	16.45	18.19	20.08	20.37	22.24	23.65	22.4-24.9

1/ Calculated using nominal dollar balance sheet data, including farm households, for December 31 of each year. 2/ Midpoint of estimated range. 3/ Fiscal year. 4/ Deflated using the Consumer Price Index (1967=100). 5/ Production Credit Association. 6/ Short-term rate reported by agricultural banks in the Ninth (Minneapolis) Federal Reserve District. 7/ Outstanding farm debt divided by the sum of farm real and nonreal estate asset values.

to total \$29 billion, down 7 percent from fiscal 1985 and 34 percent below the 1981 record. U.S. export potential is being diminished in part by strong competition from major foreign exporters and record crop production worldwide. Although the new farm program will lower loan rates for the major export commodities, it is not expected to have much immediate impact on U.S. commodity export potential.

Total farm production expenses in 1986 are projected to fall about 3 percent from a year earlier to \$131 billion. Farmers are expected to pay about the same or less for most farm inputs this growing season and borrowing costs for new farm loans are projected to remain constant. Lower farm expenses, however, will be offset by reduced gross farm receipts, causing net income levels to decline. Net farm income is projected to range between \$22 to \$26 billion, compared with \$25 to \$29 billion in 1985.

Due in part to expected weakening of

commodity export potential and lower farm income in 1986, the farm equity situation will continue to deteriorate. The projected December 31, 1985, debt-asset ratio of 23.6 sustains the sharp upward trend that began in 1980 and implies further erosion in the financial well-being of the U.S. agricultural sector. As during most of the 1980's, the significant rise in the debt-asset ratio has resulted from a severe decline in the value of farm real estate assets, particularly in the Corn Belt and Northern Plains. With farm real estate values projected to fall, farm equity continues to decline.

The December 31 value of total farm real estate assets declined an estimated 8 percent between 1984 and 1985, and is forecast to fall an additional 3 to 6 percent in 1986. The value decline in farm real estate assets, coupled with little expected change in the value of nonreal estate farm assets and a large outstanding farm debt, indicate further weakening in farmers' ability to assume additional intermediate- or long-term debt.

Consequently, domestic demand for farm machinery will be further adversely affected. Capital expenditures for new and used tractors are forecast to total \$1.8 to \$1.9 billion in 1986, compared with an estimated \$2.05 billion last year (table 23). Expenditures for all other new and used farm machinery, are expected to fall between \$3.45 and \$3.6 billion from \$4.05 billion a year earlier. The projected declines are due somewhat to anticipated reductions in farm machinery prices, but for the most part reflect expected lower unit sales.

If these projections are realized, the domestic farm machinery industry probably will continue efforts to curb production to keep inventories in line with sales. The industry is also likely to offer a wide range of more attractive incentives to encourage sales of new farm machinery.

Farm Machinery Unit Purchases

Purchases of most major farm machinery items dropped markedly in 1985 from a year earlier and are expected to decline further this year. In particular, purchases of all over-100 horsepower (hp) farm wheel tractors and grain harvesting equipment fell significantly. The trend toward buying wheel

tractors with less hp, which began in 1982, was accentuated in 1985. The average hp for sales of over-40 hp wheel tractors fell to about 96 in 1985, compared to 104 in 1984 and the 1980/81 peak of 111.

The 1985/86 unit sales projections for the major farm wheel tractor categories clearly illustrate the declining trend in average hp. U.S. farm sales of 40-99 hp two-wheel drive tractors fell 1 percent in 1985 to 37,840 units and are anticipated to rise 1 percent to 38,150 units this year (table 24). Sales of these tractors have been flat since 1983. Annual sales of over-100 hp two-wheel drive tractors, down 28 percent to 17,710 units in 1985, are expected to decline another 20 percent to 14,100 units in 1986. Four-wheel drive tractor sales have dropped precipitously during the 1980's, down 27 percent from 1984 to 2,910 units last year, and are projected to fall another 16 percent to 2,450 units this year.

Harvesting and haying equipment sales will decline substantially as well. Sales of self-propelled combines and corn heads, both off about one-fourth to 8,410 and 4,800 units last year, are forecast to fall approximately one-fifth to 6,875 and 3,825 units, respectively, in 1986. Forage harvester sales fell 30 percent to 2,460 units in 1985 and are

Table 24--Domestic farm machinery unit purchases

Machinery category	Annual average		1984	Preliminary 1985	Forecast 1986	Change 1985-86
	1978-80	1981-83				
	Units			Percent		
Tractors:						
Two-wheel drive--						
40-99 hp	62818	43421	38260	37840	38150	1.0
Over-100 hp	59543	33528	24505	17710	14100	-20.4
Four-wheel drive	10276	7188	3975	2910	2450	-15.8
Grain and forage harvesting equipment:						
Self-propelled combines	29834	18594	11437	8410	6875	-18.3
Corn heads	20338	10608	6419	4800	3825	-20.3
Forage harvesters 1/	11145	5611	3538	2460	2150	-12.6
Haying equipment:						
Balers 2/	17501	10528	8315	7040	6350	-9.8
Mower conditioners	23392	15586	13057	11245	10125	-10.0

1/ Shear bar type. 2/ Producing bales up to 200 pounds.

Source: Historical data are from the Farm and Industrial Equipment Institute (FIEI). Unit sales projections are ERS forecasts. Inventory-to-purchase ratios presented in the farm machinery graphs were computed from data obtained from FIEI.

expected to total 2,150 units this year. Sales of small balers that produce up to 200-pound bales dropped 15 percent to 7,040 units in 1985 and are anticipated to decline another 10 percent to 6,350 units. Mower conditioner sales, down 14 percent to 11,245 units in 1985, are projected to fall 10 percent to 10,125 units.

Supplies

Sharp cuts in the production of farm machinery initiated in 1984 and sustained through 1985 have caused current inventories of the major farm machinery items to decline. Inventories of over-40 hp farm wheel tractors fell steadily throughout 1985, reaching the lowest levels reported since the mid-1970's during the second half of the year. Inventories of all harvesting and haying equipment followed seasonal patterns throughout 1984, but for most items fell to mid-1970 levels throughout 1985.

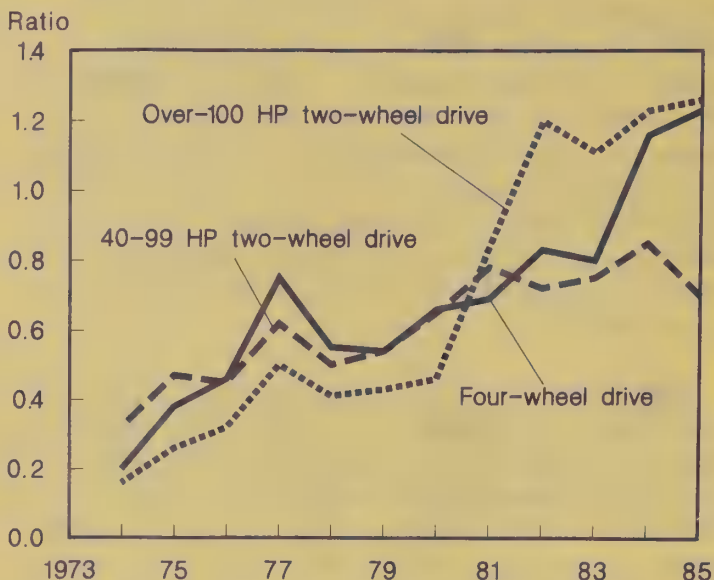
Although current farm machinery inventories in absolute terms declined substantially in 1985, unit sales have fallen to the extent that inventories, relative to current demand, have risen for 5 of the 9 major machinery categories. With unit sales of farm machinery expected to decline further this year, domestic manufacturers will operate at relatively low production rates in an effort to peg output to slumping demand and to reduce inventory finance costs.

November inventory-to-purchase ratios (IPR's) for the major farm machinery categories reflect a mixed picture. An IPR is a measure of the inventory of an item in a given month relative to its respective sales during the previous 12 months. An IPR value of 1.25 means there currently is an inventory sufficient to satisfy 25 percent more demand than was realized during the past year. In other words, there is a 15-month inventory in the market. For 40-99 hp two-wheel drive tractors, the November inventory declined from a 10.2-month supply in 1984 to an 8.4-month supply last year. On the other hand, the inventory for over-100 hp two-wheel drive tractors for the same points in time rose slightly from a 14.8- to a 15.1-month supply. Also, the November IPR for four-wheel drive tractors increased 6 percent to a level sufficient to satisfy 14.8 months of demand.

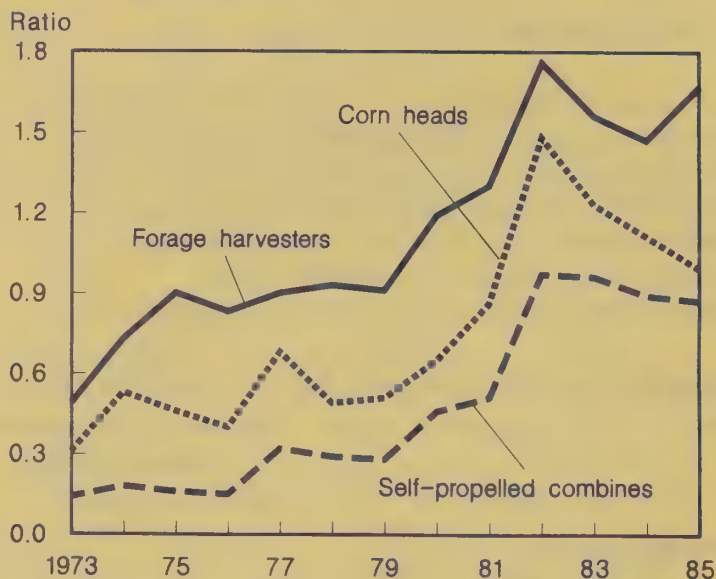
November IPR's for the two major grain

November Inventory-to-Purchase Ratios

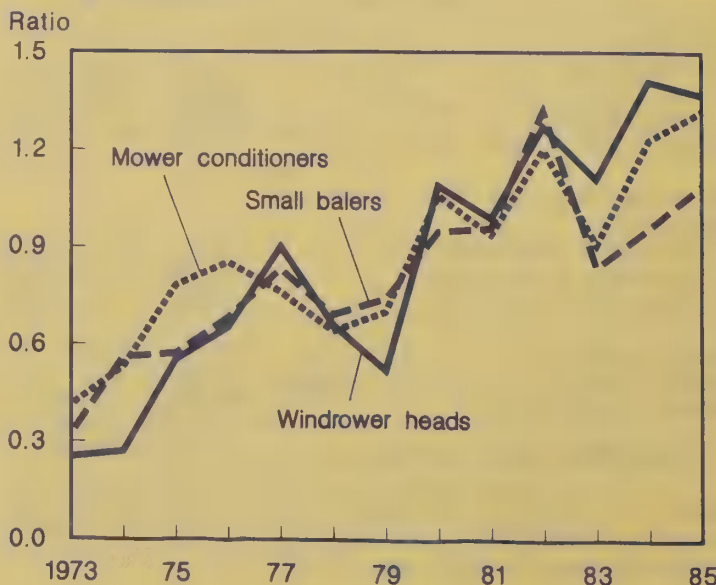
Farm Wheel Tractors



Harvesting Equipment



Haying Equipment



harvesting equipment categories dropped in 1985, sustaining a decline from 1982 record highs. The November inventory for self-propelled combines declined from a 10.7-month supply in 1984 to a 10.4-month supply in 1985, while the corn head inventory fell 11 percent from a 13.3- to an 11.9-month supply. The inventory of forage harvesters for November, however, rose 14 percent from a 17.6-month supply in 1984 to a 20-month supply last year.

In general, November haying equipment IPR's rose in 1985 because of a sharp decline in unit sales. Small baler inventories rose from just under a 1-year supply in 1984 to a 13.1-month supply last year. The November inventory for mower conditioners also increased from a 14.8- to a 15.8-month supply. The windrower head inventory, however, dropped slightly to a 16.4-month supply.

Foreign Trade

The domestic farm machinery industry has made a strong commitment to restructure its operations in response to the sustained downturn in domestic sales. Restructuring has led to the gradual relocation of most domestic wheel tractor production capacity overseas. During the mid-1970's farmers demanded higher horsepower units, domestic manufacturers stopped production of under-40 hp wheel tractors and contracted with Japanese firms to manufacture these units. This relocation was followed by the recent transfer of virtually all 40-99 hp farm wheel tractor production to Western Europe and, to a lesser extent, Japan. U.S. subsidiaries based in Western Europe produce most of the 40-99 hp tractors shipped to the United States. Recently, domestic manufacturers have begun to shift production of some over-100 hp farm wheel tractors to Western Europe. For the most part, manufacturers have decided to relocate tractor production abroad to offset foreign tariff and nontariff barriers to U.S. farm machinery and compete more effectively in these markets. The relocation is also an effort to lower overall production costs and take advantage of the duty-free status of farm machinery entering the United States.

Currently, U.S. exports and imports of farm machinery are declining. Through the

Table 25--Farm machinery trade situation 1/

Trade, area	January-October		Change 1984-85
	1984	1985	
	Million dollars		Percent
Exports to:			
Africa	101.1	82.5	-18
Australia	175.4	113.7	-35
Canada	768.3	676.9	-12
Central America 2/	34.7	31.4	-10
Eastern Europe	21.3	29.8	40
Far East	56.8	33.1	-42
Mexico	90.8	195.0	115
Middle East	25.3	21.6	-15
Near East	14.4	11.1	-23
Oceania	4.9	3.8	-22
Saudi Arabia	230.9	86.4	-63
South America	76.2	87.7	15
Western Europe	295.7	207.1	-30
Total	1895.8	1580.1	-17
Imports from:			
Africa	5.9	10.1	71
Canada	474.9	358.5	-25
Central America 2/	10.9	6.9	-37
Eastern Europe	22.4	17.9	-20
Far East 3/	7.9	8.6	9
Italy	132.6	106.3	-20
Japan	273.3	289.6	6
Middle East	3.5	5.7	63
Near East	0.3	0.4	33
Oceania	13.7	13.1	-4
South America	10.3	10.8	5
United Kingdom	192.4	177.0	-8
West Germany	189.3	184.0	-3
Western Europe 4/	142.9	131.4	-8
Total	1480.0	1319.9	-11
Trade balance 5/	415.8	260.2	-37

1/ Includes finished machinery items, nonassembled machinery, and parts. 2/ Includes Caribbean countries and excludes Mexico. 3/ Excludes Japan. 4/ Excludes Italy, the United Kingdom, and West Germany. 5/ Trade balance is slightly overstated due to rounding of country export and import totals.

Source: U.S. Department of Commerce. Trade Development, Office of Special Industrial Machinery.

first 10 months of 1985, the farm machinery trade balance stood at a positive \$260 million, 37 percent below a year earlier (table 25). The value of U.S. farm machinery exports fell 17 percent from \$1.9 billion to \$1.58 billion, while the value of imports declined 11 percent to \$1.32 billion from a year earlier. Despite the decline in imports through October 1985, there is a growing reliance on imported farm machinery in the United States. Japan

currently ranks second behind Canada in value as the chief supplier. As more domestic tractor production capacity is relocated abroad, and exports continue to decline, a positive farm machinery trade balance will be increasingly difficult to maintain.

Historically, foreign trade has been one of the more successful facets of the domestic farm machinery industry. However, Canada and Australia, which have traditionally accounted for approximately 50 percent of the total value of all U.S. farm machinery exports, are no longer considered growth markets for new farm machinery. Much like the United States, Canada, and to a much lesser extent Australia, are replacement markets. Also, the Canadian farm economy is plagued by many of the same problems that continue to affect U.S. farmers' ability to purchase new machinery. The value of wheel tractors and tractor part exports to Canada and Australia was down 8 and 29 percent, respectively, while harvesting machinery exports fell 25 and 48 percent as of October 1985. As a result, the value of all farm machinery exports to Canada and Australia decreased by 12 and 35 percent, respectively.

Reduced exports to Saudi Arabia and Western Europe also contributed to the decline in the farm machinery trade balance. Exports to Saudi Arabia fell more than 60 percent in value, while exports to Western Europe fell 30 percent from a year earlier. Reduced exports to Saudi Arabia resulted from a leveling off in its initial agricultural modernization program that required sophisticated center pivot irrigation pumping systems. In Western Europe, U.S. farm machinery subsidiaries' dependence on domestic manufacturers for such original machinery components as tractor parts is declining.

The resurgence of Mexico as a major export market in 1985 helped offset an otherwise dismal export situation. Farm machinery exports to Mexico increased 115 percent to \$195 million as of October 1985. Wheel tractor, tractor parts, and harvesting machinery exports accounted for \$150 million, or more than 75 percent of the total. The substantial gain in U.S. farm machinery exports to Mexico occurred after the relaxation of several years of restrictive import policies. Current trade data indicate

that the value of exports to Mexico for all of last year could reach its highest level since 1981 (\$260 million).

The severity of the 6-year slump in domestic farm machinery demand is illustrated by the decline in the value of U.S. farm machinery imports. The stagnant outlook for 40-99 hp wheel tractor sales in the United States has had a decidedly negative effect on imports from Western Europe. This is especially true for Italy, the United Kingdom, and West Germany, which are the points of origin for practically all mid-size farm wheel tractors marketed in the United States. During January-October 1985, the total value of farm machinery imports from West Germany, the United Kingdom, and Italy declined 3, 8, and 20 percent, respectively.

On the other hand, imports from Japan continue to grow in value. This indicates the overall strength of the nonagricultural under-40 hp tractor market in the United States. The demand for small wheel tractors is determined more by the economic health of the general economy than by economic conditions in the agricultural sector. In 1984, Japan produced 85 percent of the value of all under-40 hp wheel tractors imported by U.S. manufacturers. The value of all farm machinery imports from Japan rose 6 percent from a year earlier to \$290 million.

ENERGY

World Outlook

Petroleum Consumption

Petroleum consumption in the non-Communist world declined by about 600,000 barrels per day (1 percent) from 1984 to 1985 and is projected to remain flat in 1986. The decline resulted from decreased petroleum use in Japan, Europe, and other market economies excluding the United States, which has stable demand, as economic growth in the industrial countries slipped from 4.6 percent in 1984 to 2.8 percent during 1985. Although oil prices are expected to fall during 1986, petroleum demand in the market economies will continue to decline because of conservation measures. Furthermore, the substitution of other fuels for oil will

continue, even with the recent oil price declines.

Crude Oil Production

World oil supplies dropped more than 3 percent in 1985 following nearly a 3.5 percent increase in 1984. The largest part of this decline came from the OPEC countries, who decreased production 10 percent due to declining demand and increased competition from non-OPEC oil producing countries. Net oil exports from Communist countries also fell by about 300,000 barrels per day during 1985. World crude oil production is expected to rise nearly 2 percent during 1986 as OPEC countries increase output and place additional crude on the world market.

World Oil Prices

The recent shift in OPEC policy emphasizing the decision to protect its world market share points to a glut in the world oil market and subsequent price reductions. OPEC's current benchmark price of \$28 per barrel and the official ceiling on OPEC production of 16 million barrels per day have been widely ignored. Current OPEC production ranges from 17.5 million to 18.5 million barrels per day.

Saudi Arabia, which has ceased to be the swing producer, is expected to produce at its quota of 4.3 million barrels per day. As early as September, Saudi Arabia entered into an agreement with major oil companies, whereby it would sell oil at a discount from its official price. At that time, the price was estimated to be \$2 per barrel below the official marker price of \$28 per barrel.

Stable world petroleum demand and increased production point towards continued oil price declines. World spot market prices have declined considerably since November 1985, as the market reacted to increased production by major supplying countries. Spot market crude oil prices, as reported most recently, have slipped to a range of \$15 to \$20 per barrel, and are likely to decline further. To translate crude oil price declines into fuel prices, a rough rule of thumb is for each \$1 drop in the price of crude, fuel prices could decline about 2.4 cents per gallon providing the entire decline is passed onto consumers.

U.S. Energy Outlook

According to preliminary data published by the U.S. Department of Energy, 1985 domestic energy consumption reached an estimated 74.8 quadrillion Btu, up 1 percent from 1984. The increase has been revised down from the 2 percent estimated in August 1985. The difference is primarily due to a downward revision in the growth of real Gross National Product (GNP) from 3.1 percent to 2.4 percent. During 1986, energy consumption is projected to increase again by 1 percent to 75.9 quadrillion Btu, reflecting an estimated GNP growth of 2.1 percent.

Energy consumption per 1972 dollar of real GNP fell from 45,000 Btu in 1984 to 44,600 in 1985, and is projected to decline further to 44,300 in 1986. A drop in 1986 would be the sixteenth consecutive decline in the energy intensity of U.S. economic activity, reflecting continued energy conservation as well as a change in the mix of goods and services produced in the United States.

U.S. energy production, which reached an alltime high of 66.1 quadrillion Btu in 1984, declined slightly in 1985 to 65.6 quadrillion Btu, as declines in natural gas, coal, and hydropower more than offset a significant increase in nuclear power. In 1986, U.S. energy production is projected to reach a record 67 quadrillion Btu, with all major energy sources contributing to the increase.

U.S. Energy Consumption and Production by Major Fuels

Petroleum remains the most significant source of U.S. energy, accounting for 42 percent of the total consumption. In 1985, consumption of all major petroleum products was 15.7 million barrels per day, nearly the same as in 1984 (table 26). Consumption in 1986 is projected to remain close to the 1985 level. Growth in the economy is expected to stimulate a slight increase in energy demand, but the increase is projected to be met by continued improvements in energy efficiency and use of fuels other than petroleum to generate electricity.

Motor gasoline consumption was 6.8 million barrels per day in 1985. Despite improvements in fuel use efficiency, demand

Table 26--U.S. petroleum consumption--supply balance

Item	1983	1984	1985 1/	1986 2/
Million barrels per day				
Consumption:				
Motor gasoline	6.62	6.69	6.80	6.76
Diesel fuel	2.69	2.84	2.88	2.89
Residual fuel	1.42	1.37	1.20	1.15
Other petroleum 3/	4.50	4.82	4.81	4.92
Total	15.23	15.72	15.69	15.72
Supply:				
Production	10.79	11.11	11.11	11.16
Net imports (excludes SPR)	4.08	4.52	4.06	4.38
Net stock withdrawals	0.25	-0.08	0.23	0.03
Total	15.12	15.55	15.40	15.57
Percent change from previous year				
Consumption		3.2	-0.2	0.2
Production		3.0	0	0.5
Net imports		10.8	-10.2	7.9
Net import as share of U.S. supply		29.1	26.4	28.1

SPR = Strategic Petroleum Reserve.

1/ Preliminary data. 2/ Projected. 3/ Includes crude oil, pentanes plus, other hydrocarbons and alcohol, unfinished oil, and gasoline blending components.

Source: U.S. Department of Energy, Energy Information Administration. Short-Term Energy Outlook. DOE/EIA - 0202(85/4Q), October, 1985.

increased 1.6 percent from 1984 due to increased travel. Consumption is projected to decline slightly in 1986 as efficiency increases are likely to outweigh greater travel.

Following a more than 5-percent jump in 1984, distillate fuel consumption rose only 1.4 percent in 1985, reflecting moderation in economic growth, particularly in the industrial sector. Diesel consumption increased slightly in 1985 because of lower real prices.

Residual fuel oil consumption, which has declined each year since 1976, fell 12.4 percent last year. Much of the decline is attributable to the continued substitution of coal and nuclear energy for residual fuel oil in electricity generation. Consumption is likely to decline only 4 percent in 1986, as lower fuel oil prices make natural gas less attractive for electricity generation in some areas of the country.

In 1985, domestic petroleum supplies remained unchanged from 1984's 11.1 million barrels per day. Supplies are expected to increase only slightly in 1986.

Net oil imports, excluding the Strategic Petroleum Reserve (SPR), were 4.06 million barrels per day in 1985, down 10.2 percent from 1984. Net oil imports are projected to rise nearly 8 percent in 1986. The share of total petroleum supply attributable to net imports (excluding SPR) was 26.4 percent in 1985, but is projected to increase to 28 percent in 1986. In 1984, the share was 29 percent.

Natural Gas

Natural gas consumption totaled 17.8 trillion cubic feet in 1985, up 0.6 percent from 1984. This year, consumption is projected to remain at the 1985 level. Decreased demand for natural gas used in electricity generation is expected to be offset by increases in all other uses.

Electricity

Electricity generation for 1985 was 2,416 billion kilowatt hours, 1.7 percent above 1984. It is expected to increase by almost 2 percent between 1985 and 1986.

Farm Energy Use and Prices

The agriculture sector's energy supply and price expectations largely reflect world market conditions, which are characterized by plentiful supplies of oil and sagging prices. The U.S. farm energy outlook has not changed materially in the past several months. Farmers can expect adequate supplies of gasoline and diesel fuel at somewhat lower prices.

Farm energy use probably declined slightly from 1984 to 1985, largely due to continued improvements in farm production technology designed to achieve reduced energy use per unit of output. These improvements include adoption of energy-conserving practices in tillage and crop drying. In addition, reduced energy use reflects a reduction in acreage planted in 1985. Farm energy use in 1986 will decline with fewer crop acres planted and the continued adoption of energy-conserving practices.

Prices

Fuel prices paid by farmers decreased in 1985 from a year earlier, following the decline in world oil prices. In 1985, farmers paid an average of \$1.15 a gallon for bulk delivered gasoline, \$0.97 a gallon for diesel, and \$0.73 cents a gallon for LP gas (table 27). Gasoline prices fell 1 cent per gallon from 1984,

Table 27--Average U.S. farm fuel prices 1/

Year	Gasoline	Diesel fuel	LP gas
Dollars per gallon			
1977	.57	.45	.39
1978	.60	.46	.40
1979	.80	.68	.44
1980	1.15	.99	.62
1981	1.29	1.16	.70
1982	1.23	1.11	.71
1983	1.18	1.00	.77
1984	1.16	1.00	.76
1985	1.15	.97	.73

1/ Bulk delivered

whereas diesel fuel and LP gas declined by 3 cents. Farm fuel prices are expected to drop further in 1986.

Electricity prices to nonindustrial consumers rose about 4 percent in 1985 and are projected to increase at the same rate during 1986. Electricity price changes are the result of changing capital and fuel costs. Stable or declining fuel prices are not expected to offset rising industry capital costs.

Natural gas prices are not expected to rise significantly. Projected flat demand for natural gas and a lower price floor on Canadian exports of natural gas to the United States have led to the stabilization of U.S. natural gas prices.

TRENDS IN INPUT EXPENDITURES, PRICES, QUANTITIES AND TECHNOLOGY IN THE CORN BELT 1/

By Dan Lass

Assistant Professor
Department of Agricultural and Resource Economics
University of Massachusetts

Abstract: Corn Belt farming illustrates how the quantity used and prices of agricultural inputs, and expenditures for them, have changed over time. Divisia form indices show that Corn Belt input expenditures grew at an average annual rate of 6 percent between 1950 and 1982. Pesticide, fertilizer, and tractor and machinery expenditures grew at annual rates of 14, 8, and 7 percent, whereas purchased livestock, hired labor, and purchased feed had the smallest expenditure growth rates at 2.2, 4.1, and 4.5 percent. This pattern of input use reflects the change from general crop and livestock farming to intensive row crop production in the Corn Belt. Input prices rose 3.9 percent a year during 1950–82, compared with 4.4 for the general Consumer Price Index. Price increases averaging 7 percent a year dominated input expenditure growth from 1967–82, while gains in input use averaging 3 percent annually were more important from 1950–67. Technological developments in fertilizer and pesticides were most influential in changing Corn Belt farming. The development of concentrated fertilizers reduced the relative cost of plant nutrients and in 1982 the implied saving was \$93 per nutrient ton. Herbicide use increased from virtually zero to 95 percent of the acres treated, displacing labor, fuel, and machinery inputs.

Keywords: Divisia index, input use, technology adoption.

Introduction

The volume and mix of agricultural inputs have changed significantly over the past three decades. While shifts in agricultural output account for much of the change, other factors such as relative input prices and technological advances also have dictated input use. Numerous technological changes have occurred in the Corn Belt since 1950 and the region (Illinois, Indiana, Iowa, Missouri and Ohio) is illustrative of trends in agricultural input expenditures, prices, quantities, and technology.

1/ This article was prepared at the request of the Economic Research Service. It is drawn from the author's doctoral dissertation at Penn State University titled: *Estimation of Total Factor Productivity Growth in the Corn Belt: A Dual Approach to Measurement*. The views are those of the author and do not necessarily represent the position of USDA.

Data and Methods

The Divisia index is frequently used to measure growth in prices, quantities, or expenditures of a group of heterogeneous materials or products. Ideally, the growth of an index also reflects the weights of individual items included in it and changes in the weights over time (2, 7). The Divisia index aggregates heterogeneous items by summing the share-weighted growth of each item. Weights within the Divisia index are each individual item's share of the total value of the aggregate. For example, individual fertilizer nutrient expenditures are divided by total fertilizer expenditures to derive annual cost shares. These shares are then used as weights in forming the Divisia price and expenditure indices for fertilizers. The weights or annual cost shares in the Divisia index are permitted to change annually to capture shifts in the material or product mix within an aggregate category.

The Divisia index was used for 10 categories in this study. Adequate data were not available to calculate Divisia indices for machinery repair supplies and other miscellaneous farm supplies. A Laspeyres-type index was used for these two input aggregates using quantity share weights (8). Implicit quantity indices for the variable inputs were derived from their respective expenditures and price indices.

Durable inputs such as tractors, farm machinery, motor vehicles, and farm buildings were measured in terms of the flow of services from stocks of these assets (15). Rental markets for such inputs typically do not exist or do not operate actively enough to

provide adequate service price information. The service flow price and quantity indexes were based on the assumption that an asset's purchase price and the discounted value of its future services are equal. The service flow price index includes components that account for the opportunity cost of the asset, depreciation charges, capital gains or losses, and taxes on capital income.

Input Expenditures

The expenditure index for all variable inputs has increased 485 percent since 1950 (table 28). During 1950-82, pesticide expenditures increased nearly 7,500 percent and fertilizer and limestone expenditures by

Table 28--Change in variable input expenditure, price, and quantity indices, 1950-82

Input category	Total expenditure index	Share of total variable expenditures		Annual growth rates		
		1950	1982	Expenditures	Prices	Quantities
Percent						
Purchased feed	307	19.5	13.6	4.5	3.0	1.5
Purchased livestock	99	16.7	5.7	2.2	2.7	-0.5
Hired labor	261	8.6	5.3	4.1	5.0	-0.9
Machinery repair and supplies	506	6.3	6.5	5.8	3.4	2.4
Motor vehicles	343	4.3	3.2	4.8	5.3	-0.5
Farm buildings	332	5.6	4.1	4.7	5.2	-0.5
Miscellaneous farm supplies	542	9.5	10.4	5.9	4.0	1.9
Fertilizer and limestone	1267	5.0	11.7	8.5	3.0	5.5
Pesticides	7497	0.3	3.9	14.5	3.2	11.3
Tractors and farm machinery	849	15.4	24.9	7.3	3.7	3.6
Motor fuels and oils	520	5.7	6.0	5.9	4.3	1.6
Purchased seed	786	3.1	4.7	7.1	7.5	-0.4
All variable inputs	485	100.0	100.0	5.7	3.9	1.8
Consumer price index	--	--	--	--	4.4	--

Sources: (10,12,15,17).

more than 1,250 percent. On the other hand, expenditures for purchased livestock rose only 99 percent and hired labor 260 percent. Expenditures for tractors and farm machinery advanced 849 percent, while machinery repair supplies and motor fuels and oils increased by over 500 percent, indicating the rising importance of machinery and machinery repair and operation. Expenditures on purchased seed increased more than one and one-half times faster than the index of total variable input expenditures. The final category of expenditures that increased relative to total variable input expenditures was "other miscellaneous farm supplies," which includes items such as hardware, small hand tools, miscellaneous livestock supplies, containers, and telephones.

The relative importance of each input category is indicated by its share of total variable expenditures (table 28). Purchased feed and purchased livestock accounted for the two largest shares of variable expenditures in 1950. By 1982, tractors and farm machinery became the dominant group, accounting for 25 percent of variable expenditures. The share for fertilizers and limestone increased from 5.0 percent in 1950 to 12 percent in 1982. Pesticides accounted for about 4 percent of variable expenditures in 1982, up from only 0.3 percent in 1950.

Prices and Quantities

Changes in expenditures can be divided into price and quantity components to indicate whether nominal price increases or changes in quantities used are more influential in determining expenditure growth. In general, input prices increased more than quantities used (table 1). The aggregate price index for all variable inputs grew at an average annual rate of 3.9 percent, while the average annual growth rate for the quantity index was only 1.8 percent between 1950 and 1982.

The average annual growth rate in the input price index was somewhat less than the Consumer Price Index, or general inflation measure, of 4.4 percent for the period. The purchased seed price index exhibited the most rapid growth, (7.5 percent), while the quantity index declined at an annual rate of 0.4 percent, indicating that the expenditure growth was due entirely to price increases.

The opposite occurred for fertilizer and limestone as well as pesticides, where price indices grew about 3 percent a year, but the quantities used index increased at 6 and 11 percent, respectively. The relatively slower growth in prices likely contributed to the substantial gains in fertilizer, limestone, and pesticide consumption. Both the price and quantity indices for the machinery-related categories also grew at annual rates greater than or comparable to the growth rate for the aggregate input price and quantity indices.

These results indicate a relative as well as absolute increase in the use of farm machinery, machinery operating inputs, pesticides, and fertilizer and limestone. At the same time, quantity indices for purchased livestock, hired labor, motor vehicles, farm buildings, and purchased seeds showed negative growth rates. The decline in farm buildings and motor vehicles may reflect fewer farm numbers as well as a declining livestock sector. The quantity indices for feed and motor fuels and oils grew at rates only slightly less than the rate of growth for the aggregate quantity index for all variable inputs.

Changing input prices and output mix accounted for much of the shift in input use. The output mix in the Corn Belt has shifted toward increased production of feed grains and soybeans (table 29). Livestock products accounted for 77 percent of the expected value of output in 1950, and crops accounted for the remainder. In 1982, livestock products accounted for 41 percent of the expected value, while the share for crops climbed to 59 percent. Feed crops and soybeans led the gains in crop production during 1950-82, growing at an annual average rate of 5.6 and 5.2 percent, respectively. Corn accounted for most of the growth in feed crop production. In contrast, output of meat animals rose less than 1 percent per year.

The Corn Belt's changing output mix is reflected in rising demand for inputs related to crop production, such as farm machinery, pesticides, and fertilizer and limestone. Similarly, the decline in livestock production relative to crops is consistent with the observed downward trend in the use of purchased feed and purchased livestock. The shift from labor-intensive livestock production

Table 29—Percentage change in the expected value of outputs and estimated average annual growth rates for expected value, price, and quantity indices in the Corn Belt, 1950–82

Commodity	Change in expected value of output 1/	Share of total expected value of output		Annual growth rates		
		1950	1982	Expected value of output	Expected prices	Quantities
		Percent				
Dairy	179	12.3	7.4	3.3	4.5	-1.2
Poultry 2/	13	11.5	2.8	0.4	0.9	-0.5
Meat animals 3/	170	53.2	31.2	3.2	3.0	0.2
Feed grains 4/	1285	10.1	30.4	8.6	3.0	5.6
Other crops 5/	276	4.1	3.4	4.2	2.2	2.0
Soybeans	1188	8.8	24.7	8.3	3.1	5.2

1/ Farmers were assumed to base their production decisions on their expectations of future output prices. The values for outputs were therefore calculated using price series which were hypothesized to reflect farmers' expectations of output prices. Expected output prices were measured by futures prices for those outputs which were consistently traded through the 1950–1982 period. A single period lag was used for those outputs for which futures prices were not available (see (8) for more detail). 2/ Poultry includes chickens, broilers, eggs, and turkeys. 3/ Meat animals includes cattle, calves, hogs, sheep, and lambs. 4/ Feed crops includes corn, barley, oats, sorghum, and hay. 5/ Other crops includes wheat, rye, processing vegetables, fresh market vegetables, and cotton.

Sources: (10,12,15).

to crop production partly explains the decline in labor used on farms. However, labor-saving technology also has been adopted in crop production.

During 1950–82, the input expenditure, price, and quantity indices grew at varying rates (table 30). Aggregate input prices grew nearly 7 times faster during the last half of the period compared with the first, reflecting the economy-wide inflationary pressures of the 1970's and early 1980's. For example, the motor fuel and oil price index declined at an annual rate of 0.4 percent during the first period but grew a rapid 9.8 percent during 1967–82.

Compared with 1950–67, the input quantity indices grew much more slowly during 1967–82 in nearly all cases. The two exceptions were hired labor and machinery repair supplies, which showed higher growth rates during 1967–82. Hired labor may have increased in the latter period as family and operator labor resources moved out of agriculture, whereas rapidly rising machinery prices encouraged repairs to increase machine life. The trend toward increased relative use

of machinery, pesticides, and fertilizer and limestone was consistent during both periods, confirming the trend toward adoption of farm technology dominated by mechanical and chemical methods. Negative growth rates for purchased seed, motor vehicles, and farm buildings during 1967–82 appear partly associated with the above-average price increases for these inputs.

Indicators of a Changing Farm Production Technology

The use of fertilizer and limestone has increased substantially since 1950, growing at an average annual rate of 5.5 percent (table 28). During 1950–67, when nominal prices for fertilizer and limestone were stable, use rose 7.8 percent (table 30). Even during the latter portion of the period, 1967–82, fertilizer use increased nearly 3 percent annually when nominal fertilizer prices climbed 6.5 percent annually. This fertilizer use pattern was due to an increase in corn acreage planted, the proportion of acres fertilized, and higher application rates. Advances in fertilizer technology, coupled with seed and machinery developments, have allowed farmers to plant

Table 30—Annual change in variable input expenditure, price, and quantity indices, 1950–67 and 1967–82

Input category	Annual growth 1950–67			Annual growth 1967–82		
	Expenditures	Prices	Quantities	Expenditures	Prices	Quantities
	Percent					
Purchased feed	3.4	1.2	2.2	5.7	5.1	0.6
Purchased livestock	2.0	0.0	2.0	2.4	5.8	-3.4
Hired labor	0.8	3.1	-2.3	8.0	7.3	0.7
Machinery repair and supplies	3.2	1.3	1.9	8.8	5.9	2.7
Motor vehicles	2.6	2.1	0.5	7.3	8.8	-1.5
Farm buildings	3.5	2.2	1.3	6.0	8.6	-2.6
Miscellaneous farm supplies	3.3	0.7	2.6	9.1	7.8	1.3
Fertilizer and limestone	7.8	0.0	7.8	9.4	6.5	2.9
Pesticides	16.5	2.0	14.5	12.2	4.3	7.5
Tractors and farm machinery	6.2	1.2	5.0	8.5	6.5	2.0
Motor fuel and oils	2.0	-0.4	2.4	10.4	9.8	0.6
Purchased seed	3.5	3.2	0.3	11.3	12.6	-1.3
All variable inputs	3.8	1.0	2.8	7.8	7.2	0.6
Consumer prices index	—	1.9	—	—	7.3	—

Sources: (10,12,15,17).

more seeds per acre, optimize the placement of fertilizer and seed during planting, and use concentrated liquid nitrogen formulations.

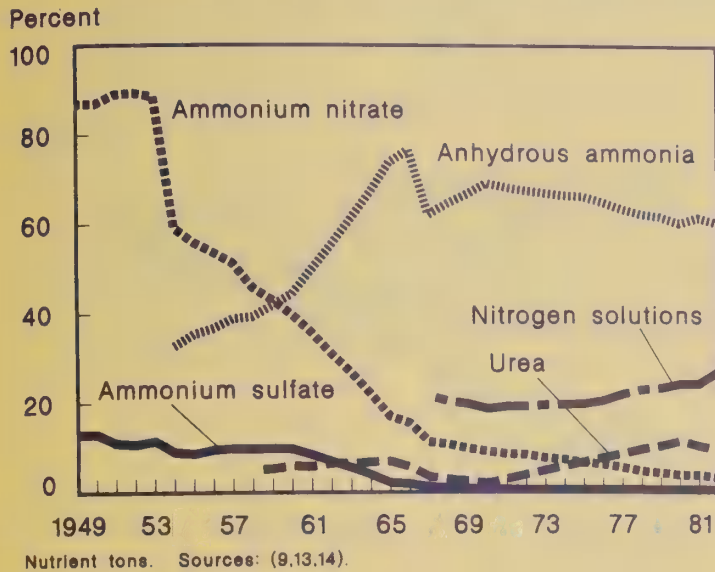
The trend in nitrogen sources has been toward anhydrous ammonia, nitrogen solutions, and urea and away from sources such as ammonium nitrate. Given the prices per nutrient ton for these materials, the increased adoption of anhydrous ammonia relative to ammonium nitrate is easily understood. The use of phosphates shows a similar trend toward more concentrated and less expensive 46-percent superphosphate relative to 20-percent superphosphate. These trends suggest that the adoption of new fertilizer technology by farmers was induced by relative price changes. By 1982, the implied cost

savings from adopting new technologies was \$93 per nutrient ton.

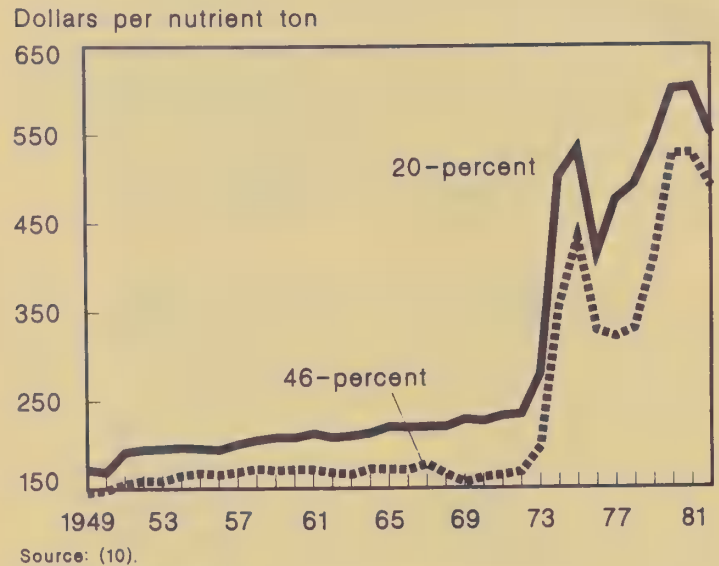
Pesticides continue to represent only a small share (3.9 percent) of variable farm expenditures (table 28). However, pesticide use grew 14 percent annually during 1950–67 and 7.5 percent annually during 1967–82, indicating wide adoption of chemical pest control. Herbicide use has increased relatively and absolutely in the last two decades to account for more than 90 percent of the total quantity of active ingredients applied, while insecticide and fungicide use has declined slightly.

In addition to greater proportions of treated acres and increased planted acreage,

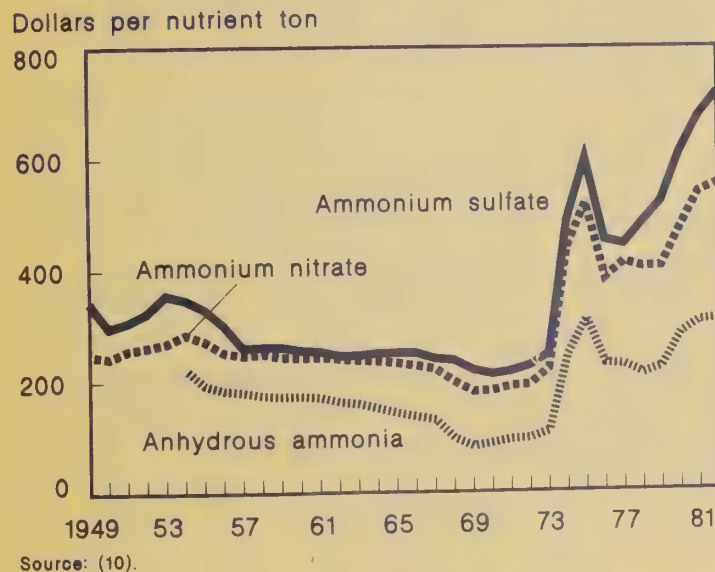
Relative Use of Nitrogen Materials



Superphosphate Prices

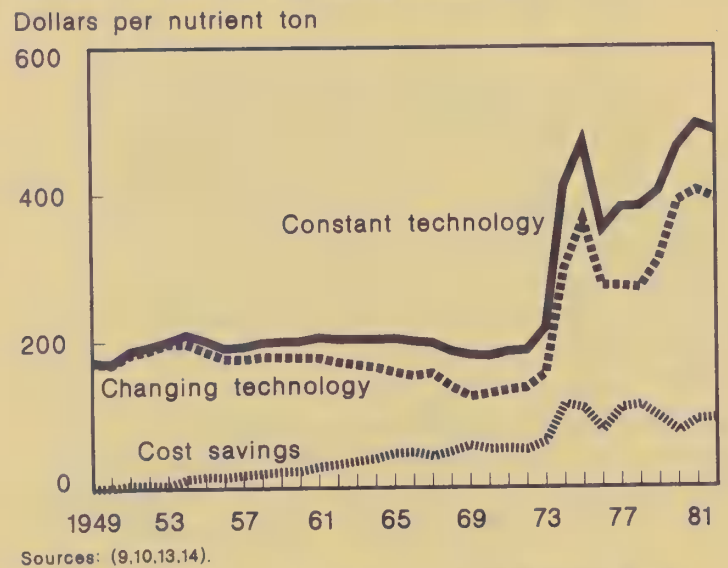


Prices of Nitrogen Materials

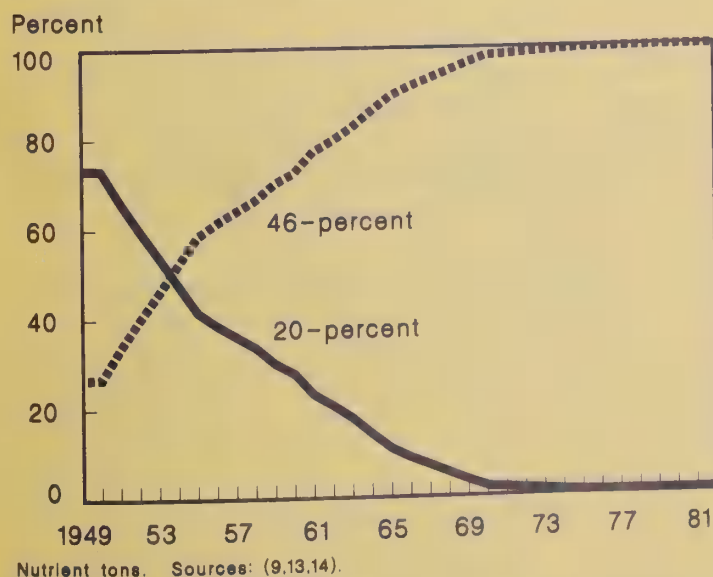


Fertilizer Prices:

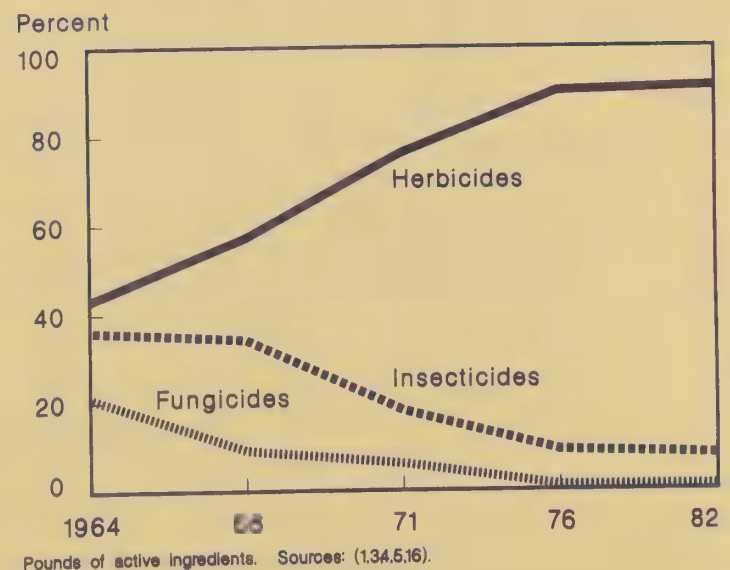
Constant Vs. Changing Technology



Relative Use of Superphosphates



Relative Use of Pesticides in the Corn Belt



the stepped-up use of herbicides reflects, in part, other changes in farm production technology. For example, the switch from banding to broadcasting has led to greater levels of herbicide use. Also, future adoption of no-till and reduced-till practices to reduce production costs, slow soil loss, and increase returns may require greater use of herbicides for weed control (6).

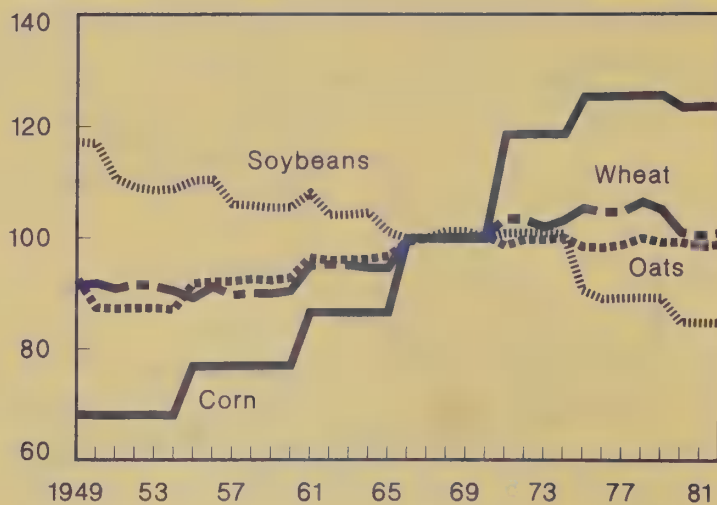
Another indicator of change in crop production technology is seeding rate trends. Genetic improvement in seeds typically results in more vigorous and higher yielding varieties. Genetic improvements in soybean varieties have in part permitted a decline in seeding rates. The opposite trend for corn demonstrates the combined effects of varietal improvements and developments in fertilizer and machinery technology that allow for increased plant population per acre.

Conclusions

Price increases were responsible for the growth in expenditures for most variable farm inputs in the Corn Belt during 1950–82. Variable input prices rose at an annual rate well below the general inflation rate during the first half of the period, but during 1967–82, growth rates nearly equaled the rate of inflation. Increases in quantities used also played an important role in input expenditure growth, particularly for fertilizer and limestone, pesticides, and machinery inputs. Increased use accounted for over 60 percent of the annual growth rates in pesticide and

Seeding Rate Trends for Major Corn Belt Crops

1967=100



Source: (11).

fertilizer and limestone expenditures. Approximately half of the annual growth in expenditures for tractors and other farm machinery was due to increases in their use.

A more complete analysis of factors influencing input changes requires attention to relative price changes, correlations between factors of production, and changes in technology. Several changes in the technology used by farmers were obvious from the data. Shifts in relative quantities of fertilizer materials, increased herbicide use, and changing seeding rates demonstrate technological changes that have occurred in Corn Belt crop production.

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Appendix table 1--U.S. fertilizer imports:
Declared value of selected materials for year
ending June 30

Material	1983	1984	1985	1986 1/
Million dollars				
Nitrogen:				
Anhydrous ammonia	296	443	414	157
Urea	226	255	259	84
Ammonium nitrate	34	55	55	18
Ammonium sulfate	27	27	32	9
Sodium nitrate	13	11	15	3
Calcium nitrate	10	14	13	3
Nitrogen solutions	15	31	21	11
Other	13	17	27	9
Total 2/	635	853	836	292
Phosphate:				
Ammonium phosphates	39	35	34	8
Crude phosphates	1	*	*	1
Phosphoric acid	*	*	*	*
Normal and triple superphosphate	2	1	1	*
Other	2	1	*	*
Total 2/	44	38	36	10
Potash:				
Potassium chloride	546	603	588	159
Potassium sulfate	5	12	12	3
Potassium nitrate 3/	11	7	11	5
Total 2/	562	623	611	167
Mixed fertilizers	23	25	27	4
Total 2/	1,264	1,539	1,510	437

* Less than \$1 million.

1/ Preliminary data for July-November 1985.

2/ Totals may not add due to rounding.

3/ Includes potassium sodium nitrate.

Source: (5).

Appendix table 2--U.S. fertilizer exports:
Declared value of selected materials for year
ending June 30

Material	1983	1984	1985
Million dollars			
Nitrogen:			
Anhydrous ammonia	58	59	162
Urea	166	127	208
Ammonium nitrate	4	4	5
Ammonium sulfate	48	36	55
Sodium nitrate	3	3	4
Nitrogen solutions	11	2	*
Other	6	4	4
Total 1/	297	235	438
Phosphate:			
Phosphate rock	393	427	370
Normal superphosphate	1	*	*
Triple superphosphate	183	142	185
Diammonium phosphate	722	933	1,277
Other ammonium phosphates	51	89	86
Phosphoric acid	392	352	404
Other	1	2/	2/
Total 1/	1,742	1,944	2,322
Potash:			
Potassium chloride	52	46	66
Other	55	45	39
Total 1/	107	91	105
Mixed fertilizers	44	29	18
Total 1/	2,190	2,299	2,884

* Less than \$1 million.

1/ Totals may not add due to rounding.

2/ Effective January 1984 through June 1985,
phosphate rock exports include a small tonnage of
miscellaneous fertilizers.

Source: (4).

Appendix table 3--Plant nutrient use by State for year ending June 30 1/

State, region	1984			1985		
	Nitrogen	Phosphate	Potash	Nitrogen	Phosphate	Potash
Thousand tons						
Maine	13	13	12	13	12	12
New Hampshire	3	2	3	3	2	3
Vermont	7	6	7	8	7	8
Massachusetts	8	4	6	10	6	8
Rhode Island	2	1	1	2	1	1
Connecticut	7	5	4	7	4	5
New York	92	85	101	105	76	104
New Jersey	27	19	21	29	18	22
Pennsylvania	74	57	57	67	54	55
Delaware	25	10	21	19	9	18
Maryland	61	38	49	64	38	47
District of Columbia	2	*	*	2	*	*
NORTHEAST.....	322	240	282	329	227	283
Michigan	291	177	295	252	142	236
Wisconsin	228	148	368	273	148	411
Minnesota	506	269	357	636	284	372
LAKE STATES.....	1,025	594	1,020	1,161	574	1,019
Ohio	368	234	348	364	201	320
Indiana	521	302	446	565	276	456
Illinois	1,056	504	787	1,028	488	716
Iowa	1,043	399	609	1,137	372	542
Missouri	333	172	241	366	146	215
CORN BELT.....	3,321	1,611	2,431	3,460	1,483	2,259
North Dakota	214	109	19	272	127	26
South Dakota	133	62	16	124	57	13
Nebraska	682	154	47	806	147	42
Kansas	585	182	43	628	182	44
NORTHERN PLAINS.....	1,614	507	125	1,830	513	125
Virginia	95	65	90	97	66	90
West Virginia	12	10	10	13	13	13
North Carolina	252	128	234	249	126	217
Kentucky	193	123	156	189	122	142
Tennessee	132	109	116	140	107	122
APPALACHIA.....	684	435	606	688	434	584
South Carolina	91	46	96	97	44	91
Georgia	256	124	206	270	119	189
Florida	236	100	256	213	95	238
Alabama	153	83	104	158	76	93
SOUTHEAST.....	736	353	662	738	334	611
Mississippi	188	77	109	173	60	81
Arkansas	221	70	94	208	59	82
Louisiana	152	61	83	170	60	81
DELTA STATES.....	561	208	286	551	179	244
Oklahoma	284	99	33	280	104	35
Texas	834	281	124	817	257	127
SOUTHERN PLAINS.....	1,118	380	158	1,097	361	162
Montana	137	88	14	108	76	13
Idaho	182	58	11	184	68	20
Wyoming	22	9	1	25	8	1
Colorado	187	42	15	174	33	12
New Mexico	37	13	5	41	14	5
Arizona	88	37	1	88	27	1
Utah	29	17	*	29	17	*
Nevada	4	2	*	6	3	*
MOUNTAIN.....	687	267	47	655	246	53
Washington	234	56	39	222	58	40
Oregon	132	46	23	144	40	24
California	626	187	88	596	176	73
PACIFIC.....	993	289	150	962	274	137
48 STATES AND D.C.....	11,061	4,883	5,767	11,471	4,625	5,477
Alaska	3	2	1	3	2	1
Hawaii	16	10	17	20	11	20
Puerto Rico	12	5	12	12	5	12
U.S. TOTAL.....	11,092	4,901	5,797	11,504	4,641	5,510

* Less than 500 tons.

1/ Totals may not add due to rounding.

Appendix table 4--Fertilizer use on corn for grain, 1985

State	Acres for harvest	Fields in survey	Harvested acres receiving				Application rates			Proportion fertilized		
			Any ferti- lizer	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O	At or before seeding	After seeding	Both
	Thousand	No.		Percent			Pounds per acre			Percent		
Michigan	2,700	99	100	99	97	89	120	55	104	49	0	51
Minnesota	6,500	180	95	95	91	86	112	45	65	82	0	18
Wisconsin	3,400	153	99	99	98	95	96	49	69	61	0	39
Total	12,600	432	97	97	94	89	109	49	75	69	0	31
Illinois	11,350	221	98	98	90	88	158	80	114	76	2	22
Indiana	6,100	169	99	99	95	84	162	70	115	60	1	39
Iowa	13,350	203	100	99	85	83	145	56	73	80	4	16
Missouri	2,430	131	96	96	71	73	130	58	73	79	10	11
Ohio	4,000	162	100	98	97	94	153	68	97	56	2	42
Total	37,230	886	99	98	88	85	152	68	96	73	3	24
Nebraska	7,250	194	99	99	70	46	154	40	22	58	8	34
South Dakota	2,860	109	77	77	55	28	66	35	16	86	8	6
Total	10,110	303	93	93	66	41	134	38	21	65	8	27
10 State total	59,940	1,621	98	97	86	79	140	60	84	71	3	26

Appendix table 5--Fertilizer use on cotton, 1985

State	Acres for harvest	Fields in survey	Harvested acres receiving				Application rates			Proportion fertilized		
			Any ferti- lizer	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O	At or before seeding	After seeding	Both
	Thousand	No.		Percent			Pounds per acre			Percent		
Missouri	152	57	98	98	68	98	56	35	62	20	16	64
Tennessee	330	100	100	99	97	94	78	61	67	82	5	13
Alabama	327	94	98	98	88	80	88	62	73	76	4	20
Georgia	260	43	100	100	93	100	78	62	86	19	0	81
South Carolina	122	54	100	100	83	98	92	51	90	9	6	85
Total	709	191	99	99	90	91	85	60	82	42	3	55
Arkansas	440	103	100	100	76	77	70	37	51	33	23	44
Louisiana	635	94	100	100	70	76	80	48	64	38	28	34
Mississippi	1,040	154	98	98	42	44	104	56	59	44	27	29
Total	2,115	351	99	99	57	60	90	43	59	40	26	34
Oklahoma	355	75	59	59	32	3	34	34	10	100	0	0
Texas	4,719	535	57	57	47	22	49	39	21	76	14	10
Total	5,074	610	57	57	46	20	48	39	21	77	13	10
Arizona	450	96	95	95	51	9	157	55	6	11	57	32
New Mexico	63	53	59	59	47	2	58	48	14	77	7	16
Total	513	149	91	91	51	9	150	54	7	16	53	31
California	1,340	254	87	87	23	3	118	56	112	35	41	24
13 State total	10,233	1,712	76	76	50	34	80	46	52	53	22	25

Appendix table 6--Fertilizer use on soybeans, 1985

State	Acres for harvest	Fields in survey	Harvested acres receiving				Application rates			Proportion fertilized		
			Any ferti- lizer	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O	At or before seeding	After seeding	Both
	Thousand	No.		Percent			Pounds per acre			Percent		
Minnesota	5,140	105	19	12	14	19	26	34	62	100	0	0
Illinois	8,950	166	22	8	17	21	16	61	93	100	0	0
Indiana	4,460	103	52	23	38	50	14	40	99	100	0	0
Iowa	8,150	145	12	9	12	11	10	34	59	94	6	0
Missouri	5,180	142	23	13	21	23	12	44	60	91	6	3
Ohio	3,870	112	60	35	48	58	13	37	74	93	6	1
Total	30,610	668	29	15	23	27	13	43	81	96	3	1
Nebraska	2,360	81	30	28	25	10	18	27	13	92	8	0
Kentucky	1,230	77	47	25	46	46	21	57	75	100	0	0
North Carolina	1,730	93	56	46	55	56	16	40	70	96	4	0
Tennessee	1,360	87	66	33	59	66	19	45	63	100	0	0
Total	4,320	257	56	36	53	56	18	46	69	98	2	0
Alabama	1,120	83	65	34	65	64	14	53	57	100	0	0
Georgia	1,750	76	63	54	61	62	14	37	63	96	2	2
Total	2,870	159	64	46	62	63	14	43	61	98	1	1
Arkansas	3,700	139	24	6	21	24	24	36	55	97	3	0
Louisiana	2,190	98	33	7	32	31	21	54	73	100	0	0
Mississippi	2,700	111	33	5	32	32	16	44	69	100	0	0
Total	8,590	348	29	6	27	28	21	45	65	99	1	0
15 State total	53,890	1,618	32	17	28	30	15	43	72	97	2	1

Appendix table 7--Fertilizer use on wheat, 1985

State	Acres for harvest	Fields in survey	Harvested acres receiving				Application rates			Proportion fertilized		
			Any ferti- lizer	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O	At or before seeding	After seeding	Both
	Thousand	No.		Percent			Pounds per acre			Percent		
Minnesota	2,563	62	94	94	89	68	67	32	29	95	2	3
Illinois	750	83	92	92	84	66	84	64	76	17	15	68
Indiana	700	66	92	91	83	82	74	64	63	25	10	65
Missouri	1,370	87	92	91	78	78	72	43	51	39	26	35
Ohio	950	71	92	92	86	80	77	66	72	16	15	69
Total	3,770	307	92	92	82	77	76	57	63	26	18	56
Arkansas	570	97	72	72	25	25	146	43	52	13	60	27
Kansas	11,700	272	81	81	43	10	57	33	24	63	9	28
Nebraska	2,300	105	81	81	34	6	45	31	20	79	11	10
North Dakota	8,650	234	72	72	64	9	38	29	18	99	0	1
South Dakota	3,775	53	62	62	51	8	32	27	22	97	0	3
Total	26,425	664	76	76	50	9	48	30	21	78	6	16
Oklahoma	5,500	181	83	83	53	15	67	33	19	61	6	33
Texas	5,850	189	62	62	30	8	77	46	16	39	26	35
Total	11,350	370	72	72	41	12	72	38	18	51	15	34
Colorado	3,540	97	56	56	8	0	49	26	0	92	6	2
Idaho	1,350	139	89	89	47	19	89	33	23	45	20	35
Montana	3,680	176	67	65	65	11	28	30	11	94	1	5
Total	8,570	412	66	65	38	8	49	30	16	82	7	11
California	838	85	95	94	46	6	102	52	11	73	2	25
Oregon	1,045	115	95	95	14	4	66	40	42	58	16	26
Washington	2,690	165	96	96	27	5	74	30	33	79	6	15
Total	4,573	365	96	96	27	5	77	38	30	73	7	20
18 State total	57,821	2,277	77	77	48	16	60	35	36	69	9	22

Appendix table B--Projected world supply-demand balance of plant nutrients 1/

World regions	Nitrogen		Phosphate		Potash	
	1986	1990	1986	1990	1986	1990
Million metric tons						
Developed market economies:						
Supply	22.85	23.19	19.23	19.82	16.37	17.85
Demand	24.03	26.40	13.30	14.52	12.76	13.86
Difference	-1.18	-3.21	5.93	5.30	3.61	3.99
North America--						
Supply	11.79	12.01	9.87	10.43	9.93	11.17
Demand	11.82	13.10	5.37	5.93	6.00	6.66
Difference	-.03	-1.09	4.50	4.50	3.93	4.51
Western Europe--						
Supply	9.97	10.15	6.09	6.15	5.30	5.40
Demand	10.71	11.58	5.56	5.90	5.69	6.05
Difference	-.74	-1.43	.53	.25	-.39	-.65
Oceania--						
Supply	.26	.25	1.39	1.39	.00	.00
Demand	.32	.36	1.16	1.30	.27	.31
Difference	-.06	-.11	.23	.09	-.27	-.31
Other countries--						
Supply	.84	.79	1.88	1.85	1.14	1.28
Demand	1.18	1.36	1.21	1.39	.80	.84
Difference	-.34	-.57	.67	.46	.34	.44
Developing market economies:						
Supply	14.52	20.02	7.41	9.64	.56	.78
Demand	16.27	19.94	7.52	9.40	3.52	4.54
Difference	-1.75	.08	-.11	.24	-2.96	-3.76
Africa--						
Supply	.30	.73	2.66	3.99	.00	.00
Demand	.77	.94	.62	.80	.29	.36
Difference	-.47	-.21	2.04	3.19	-.29	-.36
Latin America--						
Supply	3.90	4.94	1.59	2.03	.11	.23
Demand	3.40	4.20	2.20	2.80	1.53	2.04
Difference	.50	.74	-.61	-.77	-1.42	-1.81
Near East--						
Supply	3.00	3.98	1.35	1.48	.45	.55
Demand	2.90	3.30	1.60	2.00	.10	.14
Difference	.10	.68	-.25	-.52	.35	.41
Far East:						
Supply	7.33	10.38	1.79	2.12	.00	.00
Demand	9.20	11.50	3.10	3.80	1.60	2.00
Difference	-1.87	-1.12	-1.31	-1.68	-1.60	-2.00
Centrally planned countries of Asia:						
Supply	12.84	14.12	2.94	3.52	.04	.08
Demand	15.30	16.50	4.35	5.30	.96	1.24
Difference	-2.46	-2.38	-1.41	-1.78	-.92	-1.16
Eastern Europe and the Soviet Union:						
Supply	22.57	22.78	8.81	9.67	12.35	13.15
Demand	16.20	18.40	10.02	11.02	9.79	11.78
Difference	6.37	4.38	-1.21	-1.35	2.56	1.37
WORLD TOTAL:						
Supply	72.78	80.11	38.38	42.65	29.33	31.86
Demand	71.80	81.24	35.19	40.24	27.03	31.42
Difference	.98	-1.13	3.19	2.41	2.30	.44

1/ Forecasts for year ending June 30.

Source: (2).

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